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TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK 377
Tank Locomotive for the Brooklyn Bridge Railway (illustrated) 378
Pneumatic Interlocking, New Boston Terminal Station, Boston & Maine R. R. 378
The Lee Spark Arrester for Locomotives (illustrated) 379
The Hussey Delivering Dredge (with inset) 379
Mineral and Metal Production in the United States in 1893 and 1894 380
Freehand Slanting Lettering for Working Drawings (illustrated) 380
Shipping a 90-ft. Span Bridge by Rail (illustrated) 383
Viaduct Substructure; Knoxville, Cumberland Gap & Louisville R. R. 383
Sewage Purification in America 387
American and French Four-Cylinder Compound Freight Locomotives (illustrated) 387
Recent Progress in Car Heating 388
The Chicago Main Drainage Channel, IV. (illustrated) 390
The Temperature of Lakes 392
The Annual Convention of the Master Car Builders' Association 392
EDITORIAL NOTES 384
Bankrupt Railways and Grade Crossing Removal —Freehand Lettering for Working Drawings— Reducing Working Drawings by Photography— A Quarter Century of Industrial Progress.
EDITORIAL:
The Handling of Dredged Material 384
LETTERS TO THE EDITOR 386
Road Repairing in North Carolina (illustrated)

Two plans for the proposed bridge across the Hudson at New York have been presented to the Secretary of War for approval: that of the Union Bridge Company, before described, sent in by the corporation representing the New York end of the bridge, and another plan made by Mr. George S. Morison, now President of the American Society of Civil Engineers, for the representatives of the New Jersey end of the bridge. Mr. Morison's plan calls for a suspension bridge with novel features, and the estimates of cost are $21,000,000 for a four-track bridge and $24,500,000 for a six-track bridge. The plan of Mr. Charles Macdonald, of the Union Bridge Company, was estimated to cost $25,000,000 for a six-track bridge, with a guarantee from the bridge company that the cost would not exceed that sum. The Secretary of War has decided in favor of the plan of the Union Bridge Company, according to a despatch from Washington.

The proposed Elm St. widening in New York city, so long discussed and actually authorized, is now strongly opposed. One of the chief reasons given for this widening was the necessity of providing a wide street east of Broadway for rapid transit purposes. As Broadway itself is now selected for this purpose, this reason falls. The opposition claim that the proposed Elm St. widening would cost $10,000,000, and interferes seriously with property rights; whereas, all the essential ends of the improvement can be secured by extending Center and Marion Sts. to Lafayette Place, at a cost of about $1,000,000. It is now rumored that the Elm St. project may be abandoned.

The Philadelphia-Sandy Hook Ship Canal Commission has received a report and estimates from Consulting Engineer N. H. Hutton. The route embraces the Delaware River to Bordentown, then across New Jersey to Raritan Bay and the ocean at Sandy Hook. The estimated cost of a canal 31 2-5 miles long, 100 ft. wide at the bottom and 20 ft. deep, would be $24,124,700. The cost of approaches to a 20-ft. canal would be from $1,000,000 to $2,000,000, and to a 28-ft. deep canal, from $3,000,000 to $5,000,000. Mr. Hutton recommends the greater depth as more likely to secure government aid as an interior route for warships.

A new Cape Cod Ship Canal Co. was incorporated on June 4, and Mr. Benjamin J. Berry, one of the incorporators, says that work will at once be commenced on the Bass River, between the towns of Yarmouth and Dennis. The estimated cost of the canal on this route is "between $5,000,000 and $8,000,000," and this difference of $3,000,000, which may mean all the difference between success and failure, must be rather uninviting to prospective investors. These latest projectors seem confident of success and promise the opening of the canal to traffic within two years. The proposed route crosses the Cape Cod peninsula many miles south of the Buzzard's Bay route.

An irrigation plant has just been completed at Crowley, La., by the Vermilion Canal Co. Boilers and engines with a capacity of 50 HP. and six 15-in. centrifugal pumps are provided to lift water to a canal said to be 8½ miles long and 80 ft. wide, with an average navigable depth of 4 to 5 ft. The pumping plant is guaranteed to lift 56,000 gallons per minute, or 80,000,000 gallons a day, to an elevation of 14 ft. The length of the canal will eventually be doubled, it is expected. Judging from the account of this work given by the New Orleans "Times-Democrat," the principal crop to be irrigated from the canal will be rice. Water is taken from the Bayou Queue de Tortue, which "rises" in the Mermentau River, in Southwestern Louisiana. The above newspaper states that while this is not the only irrigation plant in that part of the state, it is considerably the largest. The contractors for the work were Warner & Co., of New Orleans, and Mr. Henry Daspit is president of the Vermilion Canal Co.

The Cope Whitehouse Drainage Canal & Reservoir Co., says the "Egyptian Gazette," has been incorporated in Illinois for the purpose of exploiting the schemes of Mr. Whitehouse, familiar to many American engineers, for the construction of storage reservoirs on the Nile. The capital of the company is placed at $5,000,000, and the documents are supposed to convey in fee simple about 280 sq. miles of Egyptian territory under a guarantee from the government of that country. The "Gazette" says that there is altogether an air of Whitehousean vagueness about the whole scheme.

An inverted siphon in the form of a timber flume 10 ft. wide, 4 ft. 7 ins. high and 1,800 ft. long has been built beneath the South Platte River in Lincoln Co., Neb. The flume is in the line of an irrigation ditch leading from the North Platte River, some six miles distant from the siphon. At its head the ditch is 60 ft. in width, but at the siphon it is only 30 ft. wide. At this point the ditch "empties into an orifice 20 ft. square and descends into the flume by a drop of 4 ft.," to quote from the "Orange Judd Farmer," of Chicago. This work has been done wholly by the farmers who are to draw water from the ditch.

The most serious railway accident of the week was a rear collision June 5 at Locust Dale, Pa., on the Philadelphia & Reading R. R. A fast freight train overtook a coal train and the engine and several cars were wrecked, while three men were killed and buried in the wreckage. Defective orders from the train despatcher and excessive speed of the freight train are both assigned as the cause of the accident.——A logging train on the Little Bay Lumber Co.'s road in Ouachita county, Ark., jumped the track June 8 and went into the ditch. Three men were killed and six injured.——A special train on the Baltimore & Ohio R. R., carrying a fire engine from Wheeling to assist in putting out a large fire at Cameron, W. Va., on June 9, jumped the track and went down the bank. Three men were killed and five injured.

A break in the bank of the Erie Canal occurred about seven miles east of Amsterdam, N. Y., on June 5, the break being about 200 ft. long and 40 ft. deep.

While putting down dynamite cartridges for blasting on the water-works extension at Pittsburg, Pa., one workman turned on the exploding current just as another was making the electric connection with one of the cartridges. One man was killed and two or three were injured.

A light-weight Maxim rapid-firing gun was tested at Sandy Hook on June 8. This gun weighs 25 lbs., or 45 lbs. packed in its case, with extra parts and mechanism, and can be easily carried on the back of a soldier. In use it is mounted on a tripod, and the ammunition is fed from a belt containing 100 cartridges. The test for rapidity was at 500 yds. range. The gun was taken from its case on a man's back, assembled, and the first shot fired in 58 seconds. The ordinary rate of fire was 500 shots per minute, and a single shot could be fired by an expert, or it continued firing as long as the trigger was held back and the cartridges supplied. In a test for breakdown, one shot was fired which was supposed to break a part of the mechanism; this part was taken out and replaced by a new piece from the case in 26 2-5 seconds. A rate of 600 to 770 shots per minute is claimed, with balls of .302 caliber and 28 grains of smokeless powder, and 3,200 yds. effective range. Another test for accuracy of fire is soon to take place. This gun is not new, though it has been lately much improved. A similar gun was used by Stanley in his African explorations. In this trial 50 rounds were fired in 5 4-5 seconds; and the barrel was changed in 1 m. 12 2-5 s.

A striking example of the accuracy of American tools and workmanship is shown in the 12-in. guns now awaiting shipment from Watervliet Arsenal to the proving grounds at Sandy Hook. Each of these guns is 40 ft. long and weighs 115,000 lbs., yet the difference in weight between the seven guns is said to be only 5 lbs. These guns are nickel-steel tube army rifles of 40 calibers in length, instead of the usual 35 calibers. Instead of a jacket, a series of hoops are shrunk on the inner tube for nearly the whole length of the gun, and over this is shrunk a single jacket, covering about two-thirds of the length, and then another layer of long hoops. When the intricacy of this assembling process is considered, in connection with work done on lathes capable of handling guns 40 ft. long, the close agreement in weight is almost phenomenal.

The lighthouse erected by the U. S. Government at Paris Island, Port Royal Sound, S. C., is of very novel and economical construction. It is a structure of steel posts, struts and ties, triangular in form, with the sides of the base each 40 ft. long. The structure is 132 ft. high to the apex, but the focal plane of the light is 120 ft. above sea-level. The light itself is hoisted into place each night, on rails attached to one side of the pyramid, by machinery located in the house at the base. The lantern is lowered and housed during the day. The metal framework cost $9,000, and the structure complete with lantern in operation cost $12,000.

The visibility of lights at sea has been lately made the subject of experiment by the governments of the United States, Germany and the Netherlands. The word "visible" in the experiments means visible on a dark night with a clear atmosphere. The result of a large number of experiments by the German committee was that a white light of 1 candle power was visible 1.4 miles on a dark, clear night, and 1 mile on a rainy night. The American tests resulted as follows: In very clear weather a light of 1 c. p. was plainly visible at 1 nautical mile; one of 3 c. p. at 2 miles; one of 10 c. p. was visible, with a binocular, at 4 miles; one of 20 c. p. faintly at 5 miles, and one of 33 c. p. plainly at 5 miles. On an unexceptionally clear night a white light of 3.2 c. p. was readily distinguished at 3 miles; one of 5.6 c. p. at 4 miles, and one of 17.2 c. p. at 5 miles. The Dutch experiments resulted in reporting a light of 1 c. p. visible at 1 nautical mile; one of 3.5 c. p. at 2 miles, and one of 16 c. p. at 5 miles. For a green light the power required was 2 c. p., 1 mile; 15 c. p., 2 miles; 51 c. p., 3 miles; 105 c. p., 4 miles. The results of tests with a red light were about the same as with the green, but it was conclusively proved that a white light was much more easily seen.

The Mather power-bridge bill, for Buffalo, N. Y., is approved by the Mayor of that city, and may now be signed by Governor Morton. Mr. Alonzo C. Mather, of Chicago, in a recent hearing before the Mayor of Buffalo, explained his invention and disclaimed any other motive than the generation of power. He estimates that to put one wheel into position in the Niagara River, and to demonstrate its capacity for producing power, would cost about $100,000. Navigation in the river is protected by the provision for a 200-ft. drawbridge, though the International bridge nearby has only a 125-ft. draw. His device is simply a large undershot waterwheel, with its bearings mounted upon four hydraulic cylinders in such a manner that the wheel can be lifted 10 ft. out of the water, or adjusted to any depth in the water. Each wheel would be 40 ft. in diameter and 200 ft. long, and it would weigh over 500,000 lbs. The ultimate purpose is to supply electrical energy to Buffalo and the vicinity.

The Adirondack survey in New York is to be continued under the direction of Verplanck Colvin, Superintendent of the New York State Survey, the $50,000 appropriated by the last legislature being now available.

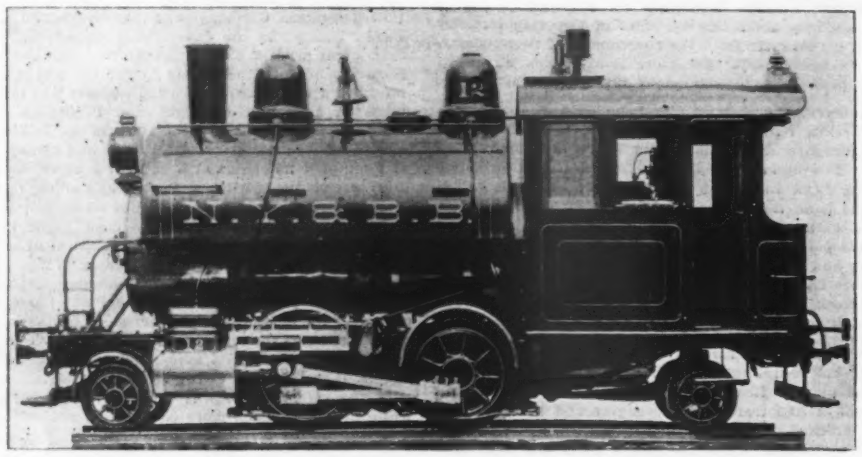
The common council of Niagara Falls, N. Y., has decided, after some discussion, that the City Engineer should be allowed to engage his own assistants.

The decimal system applied to the measurement of time and angles has for some years been closely studied by the Geographical Society of Toulouse. That body will present to the coming Geographical Congress at London the following scheme for angular measurement: It is proposed to divide the circle into 100 cirs (an abbreviation of circulus), with decimal subdivisions of decicirs, centicirs, millicirs and demicirs. An angle of 7 cirs, 77 centicirs and 51 demicirs would be written 7 x 7751, in which the letter x is chosen to designate the cir. Experiments made with the new system in Italy are claimed to show a saving in time of from 2-7 to 1-3 in making astronomical calculations. The conversion from the present to the new system would be easily made by tables, already prepared, with a possible error of less than 0.000648 second.

A practical course in electrical engineering is to be introduced into the curriculum of Union College, at Schenectady, N. Y. By special arrangement with the General Electric Co. students in electrical engineering will spend two months of each summer vacation in the shops of that company, at Schenectady, under the direction of the superintendents and experts in the several departments. Besides this there will be lectures and laboratory work in the regular course. At graduation the 10 students of highest standing will be awarded positions for one year, with pay sufficient for living expenses, for the purpose of further study and practice.

TANK LOCOMOTIVES FOR THE BROOKLYN BRIDGE.

On the Brooklyn Bridge cable railway tank locomotives are used for switching the trains from the incoming to the outgoing tracks, and also for hauling the trains at night (from 1 a. m. to 5 a. m.), when the cable driving plant is stopped for inspection and overhauling. For about ten years all the engines were of the four-wheel type, with saddle tanks, the weight increasing from 10 tons in 1883 to about 22 tons in 1893, and six of these heavier engines are still in use. As these engines had 33-in. wheels and 6 ft. wheelbase, and rapidly wore out the rails and wheels at the switches and the extremely sharp curves (100 ft. radius) over which they have to pass, and as it required two of the engines to haul a train of three cars over the bridge (the maximum grade being 3¾%), it was decided to try a heavier and more powerful engine. A



SWITCHING LOCOMOTIVE, NEW YORK & BROOKLYN BRIDGE CABLE RAILWAY.

H. K. Porter & Co., Builders.

"double-end" type was adopted, and the first was built in 1893 by the Baldwin Locomotive Works (Eng. News, Dec. 7, 1893). It has four 42-in. driving wheels, with 5 ft. driving wheelbase, and has a pony truck at each end, making the total wheelbase 17 ft. 7 ins. The weight is 68,000 lbs., with 53,000 lbs. on the driving wheels. On dry rails and under favorable conditions of track it can haul a train of four partially, or three fully, loaded cars up the maximum grade at the speed of the cable trains, or 10.3 miles per hour, this load being equivalent to about 85 to 100 tons, the heaviest cars weighing 20 tons empty.

Two more engines of the same type, but somewhat larger and heavier, have recently been built by H. K. Porter & Co., of Pittsburg, Pa., and one of these is shown in the accompanying cut. These engines can haul six empty cars or four loaded cars in regular service. The tank capacity is increased by extending the saddle tank over the smokebox, and the smokestack is made wider at the top than at the base, instead of being a cylindrical stack, as in the other engines. The engine is fitted with the vacuum brake, the same as the cars, and the Lappin flange-bearing brakeshoes of 50% hardness are used. The driving wheel tires are 3 ins. thick, and the truck wheel tires 2½ ins. thick, all 5½ ins. wide and flanged. The coiled bearing springs were specified to be of ⅞-in. rods, and the flat springs to have not less than 14 leaves 3½ ins. wide for the driving wheels and 8 leaves 2¼ ins. wide for the trucks. The three spark arrester plates are ⅛-in. thick, with holes 1½ × 3-16 in., and there is also a steel wire netting. The feed is supplied by a Korting injector and a force pump, each capable of supplying the full amount of water. A boiler compound pot is also attached, and lubrication is provided for by two Detroit automatic sight-feed lubricators in the cab. The discharge from the brake ejector is muffled, two 2½-in. Coale mufflers being fitted.

The specifications make the following provisions as to quality and tests of material: Boiler plates to be of open-hearth steel, with a tensile strength (unannealed) of 55,000 to 65,000 lbs. per sq. in., and an elongation of not less than 20% in 8 ins. Staybolt iron to be capable of bending double both ways without crack or flaw. The tubes to be rolled strictly to gage throughout their length, to show a perfect weld, be free from pitholes and other imperfections, and to be expanded when fitted into place without crack or flaw, while a 2-in. length must withstand flatting closely down under the hammer without appearance of fracture. The iron for staybolts and tubes must have a tensile strength of 50,000 lbs. per sq. in., and an elongation of 25% in 8 ins. The flues to be tested with a hydraulic pressure of 500 lbs. per sq. in., and copper and brass pipes 300 lbs. per sq. in. Springs to be oil tempered, and to sustain without set a weight equal to 1½ times the extreme working load. The boiler to be subjected to a test of 240 lbs. per sq. in. by hydraulic pressure, and 185 lbs. per sq. in. under its own steam. We give below, in our standard form, the list of dimensions and particulars of the engine:

Tank Locomotive for the Brooklyn Bridge Cable Railway.

Running Gear.—	
Driving wheels, diameter	42 ins.
Truck " "	26 "
Eng. truck, length of radius bar (front)	3 ft. 11¼ "
Engine truck	Front, swing; back, roller
Journals, driving axles	7 × 7⅝ ins.
" truck "	3¾ × 6 "
Wheel Base.—Driving	5 ft. 0 "
Total engine	18 " 11¾ "
Weight in working order.—On drivers	57,400 lbs.
On truck wheels	22,500 "
Engine, total	79,900 "
Cylinders	14 × 18 ins.
Distance center to center	6 ft. 9 ins.
" " " valve face	6 " 3 "
Piston rod, diameter	2⅝ "
Form of crosshead and guides	Double-bar guides
Connecting rod, length between centers	5 ft. 2⅝ ins.
Valve Gear.—Type	Stephenson link
Ports, length	13 ins.
" width steam	1 in.
" " exhaust	2 ins.
Slide valves, lap	⅝ in.
" " maximum travel	4 ins.
" " lead	1-16 in.
Boiler.—Type	Straight top
Diameter of barrel inside	3 ft. 11½ ins.
Thickness " " plates	7-16 in.
" " smokebox tube plate	7-16 "
Height from rail to center line	5 ft. 9¼ ins.
Length of smokebox	3 " 11 "
Working steam pressure	160 lbs.
Firebox.—Type	Flat top, crownbar stayed
Length inside	4 ft. 11 ins.
Width "	3 " ⅝ in.
Depth at front	3 " 7½ ins.
" " back	3 " 2 "
Thickness of side plates	11-32 in.
" " back plate	5-16 "
" " crown sheet	11-32 "
" " tube "	7-16 "
Grate area	15 sq. ft.
Staybolts, diam.	⅞ in.; pitch, 4¼ in.
Water space, width, front	3¼ ins.
" " " sides and back	2¾ "
Tubes.—Material	Charcoal iron
Number	166; pitch, 2 21-32 ins.
Diameter, outside	1¾ "
Thickness	No. 12 B. W. G.
Length between tube plates	8 ft. 2⅛ ins.
Total fire area of tube openings	2.2 sq. ft.
Heating Surface.—Ratio to grate area	46 to 1
Ratio of exter. tube area to firebox h't'g surf.	9.7 to 1
Tubes, exterior	623.0 sq. ft.
Firebox	64.5 " "
Total with exterior tube area	689.5 " "
Miscellaneous.—	
Exhaust nozzle, diameter, single	3¾ ins.
Smokestack, smallest diam. (stack widening from base)	13 "
Smokestack, height from rail to top	12 ft. 7 "
Capacity of saddle tank	1,000 gallons
" " coal space	1,750 lbs.
Brake fittings	Eames vacuum, Lappin flanged shoes
Tractive force per lb. effec've press. on piston	.84 lbs.
Total tractive force with effective press. = 4-5 of boiler pressure	10,752 "
Total adhesive tractive power, at ¼ of weight on drivers (tank empty)	12,000 "

PNEUMATIC INTERLOCKING; NEW BOSTON TERMINAL STATION, B. & M. R. R.

At the May meeting of the New England Railroad Club there was presented a paper by Mr. J. P. Coleman, on the pneumatic interlocking plant at the new Boston terminal of the Boston & Maine R. R., of which the following is an abstract:

Work was begun about June 1, 1893, and carried on as rapidly as the laying of the new tracks would allow. On March 18, 1894, the machine governing the Prison Point crossing of the Fitchburg R. R. was put into service, and the delay and inconvenience due to the "know-nothing" stops formerly required by law were thus avoided. Owing to the renewal of the Charles River drawbridges, and much new timber-work throughout the track system (located entirely upon piles) the interlocking at the terminal station was not put into actual service until June 17, 1894; and though considerable inconvenience was experienced on that day by both passengers and trainmen, owing to the new system and the extra trains due to the holiday, the next day found a great improvement; and by the third day, the perfect operation of the apparatus and the complete co-operation of the employees involved brought the traffic down to schedule time, which was an unusually creditable showing, owing to the very large number of trains handled, and to the fact that the system of operating the trainshed was a matter of experiment for several days, it having been the original intention in designing the terminal to use the western side of the station for inward and the eastern side for outward trains entirely.

Two days' trial of this method demonstrated it to be impracticable, for a time at least, and the method of operating the shed on the division principle was adopted: Tracks 1 to 5 were assigned to the Eastern Division, tracks 6 to 9 to the Western Division, tracks 10 to 15 to the Fitchburg R. R. (which as yet occupied its old station), and the balance of the tracks, from 16 to 23, were given up to the Southern Division. This plan proved feasible, and is the system now employed.

Some uncertainty, however, existed as to the facilities afforded for handling the Fitchburg R. R. when it was about to enter, and an additional set of six cross-overs was introduced into the track system to obviate any possible inconvenience; this and a few minor changes delayed the entrance of the Fitchburg R. R. until Aug. 12, on which day the 110 additional trains were cared for without more than five minutes' delay to any, the majority being practically on time.

Since that time the entire system has worked with marvelous smoothness, and the enormous traffic of 558 regular trains in less than 18 hours of each day are cared for without trouble.

The greatest number of train movements per hour are between 8 and 9 a. m. (37 inbound and 17 outbound trains), and between 5 and 6 p. m. (39 outbound and 18 inbound trains). There are 14 times during each day when four trains are scheduled to leave the stations at the same instant, and during the hour from 5.40 a. m. to 6.40 p. m. there are 59 trains that arrive and depart, or practically one a minute for an hour.

On an average, each train entering or leaving the station involves four movements through the system. For outbound trains the movements are as follows: 1, The empty train is backed into the shed from the yard by a shifting engine; 2, this shifter is returned to the yard, or other convenient point; 3, the road engine backs from the round-house in against the train, usually about five minutes before its departure; 4, the train starts on its regular run. For inward trains the routine is as follows: 1, The train runs into the station and discharges its passengers; 2, a shifting engine backs in against it to take the empty cars to the yard to be cleaned and inspected; 3, the shifter and empty train are signaled out into the yard; 4, the road engine is then signaled to the round-house, turntable, water plug, or coaling station, as occasion demands.

It will be seen by this that a train every minute involves a move every 15 seconds, and the man who directs these movements must not only be on the alert at all times, but must also be a man of no small supply of self-possession, as the slightest oversight on his part might produce conditions that would result in the late arrival and departure of all trains for the balance of the day, if not a total blockade of the terminal.

In the tower are six men on regular duty, for eight hours each: two directors, two levermen, a telephone man, and a telegraph operator. The director is responsible for all movements made, and all movements

are made under his instructions to the levermen. The levermen simply execute the orders of the directors, by manipulating such switch and signal levers as are necessary, to provide the necessary track connections and signals for the desired movement on the ground.

Information to the directors is conveyed from the various yards, including the train-starters, yard and station-masters' offices, by telephone. telegraph, and specially designed electrically operated indicators and annunciators, which are located in front or near his side, and are presided over by the telephone man and telegraph operator.

Each of the 23 tracks in the shed forms an independent rail circuit, which acts upon a miniature signal in the front of the train director in the tower, in such a way that when the track is not occupied by a train, the signal stands in the clear position, but when the track is covered by a train of any length the miniature signal stands at danger. This affords means during night or foggy weather of ascertaining which tracks are in condition to receive trains.

Combined in this same instrument is a second system of indicators, of a slightly different pattern, which are operated by the train-starter in the depot, and which are normally invisible. When a train is about ready to depart the train-starter operates a button in his office, which corresponds in number to the track from which the train is to leave, and thereby displays that one of the indicators in the tower, which also corresponds to that track, at the same time giving a tap upon a bell to call attention. This he does not do, however, unless personally advised by telephone that the cars have been inspected, charged with air for the brakes, and gas for the lights, and that the train crew is ready.

The train-starter is located in the center of the inner end of the shed near the roof, and has a good view of the interior of the shed from his little box-like perch, and is connected by telephone with the inner and outer ends of the shed, between each pair of tracks, so that he is kept constantly advised of the situation in the shed at all times. Any car found defective, for instance, will be reported to him, and he will advise the men in the tower and they in turn will have it removed by a shifter and another one substituted. Delays due to this, and other less important happenings, are reported to him, and the tower is thus constantly advised through him of any delay that may be expected from the trains in starting.

Air compressed to 80 lbs. per sq. in. is the motive power by which the signals and heavy steel rails of the switches and their accompanying attachments are operated, and electricity is the agency by which this pressure is so controlled as to give prompt action to the switch and signal mechanism, at any desired distance from the interlocking machine located in the tower. The air is supplied by one of two 14 × 18 Ingersoll-Sergeant compressors of the latest design, located in the terminal power house; a third compressor for emergencies being in reserve in a power house at the extreme end of the system at Prison Point.

The air on leaving the compressors passes through a system of manifold pipes of great surface area, located on the side of the power house, for the purpose of bringing it down to atmospheric temperature and thereby condensing the moisture in it (which is drained into a suitable tank and discharged at regular intervals) before it passes into the main supply pipe of the system. This air main is of 3-in. galvanized steel pipe, and runs from the power house at the terminal to the one at Prison Point, a distance of 6,000 ft., passing in duplicate under the Charles and Miller's River draws. At each switch and signal operated, it is connected by a ¾-in. branch pipe with a small reservoir for the collection of sediment or moisture that may be contained in the main, and preventing their access to the more delicate parts of the operating mechanism.

Attachments have been made to the engines of five drawbridges from this main for the purpose of avoiding the attention and expense of maintaining the pressure in five steam boilers now used for this purpose. A large duplex Blake pump is also attached to this air main, and stands constantly ready to throw a 2-in. stream of salt water from the Charles River over any fire that might develop in the vicinity of the tower and drawbridge structures.

Another purpose to which this compressed air is put is in charging the brake cylinder reservoirs of trains about to leave the shed, thus avoiding the delays often resulting from the time required by the ordinary locomotive brake pump to do this work when the locomotive is late in getting to its train. It is also contemplated to use it in operating sand conveyors and coal tipples, turntables, etc., to which purposes it is especially adaptable.

The electricity used in controlling the valves of the switch and signal device is derived from two sets of storage batteries of the Sorley type, made by the Eastern Electric Light & Storage Battery Co., of Lowell, Mass. They consist of twelve cells each, of 300 ampere-hour capacity, and are charged in series during the day by one of the large Westinghouse incandescent dynamos of the terminal power plant, which during this time is kept running to supply a few lights in the dark places in the station.

From these batteries a heavy supply wire is connected to the electrical combination of the interlocking apparatus, which is of such a construction that the movements of its many small levers, by the manipulator in the tower, causes the current to flow or to discontinue to flow in some of the 500 wires which lead therefrom and connect to the many switch and signal mechanisms of the system, the effect of which is to act upon their electro-magnetic air valves in such a manner as to produce the desired operations of the switches and signals. These wires are, for convenience, in the form of five conductor cables, and for the terminal plant alone aggregated in length 325,000 ft. of single wire.

As the Charles River practically cuts in two the system of tracks, submarine cables are used under this river to control the switches and signals on the depot side; these comprise six 61-conductor cables, placed in 3-in. galvanized iron pipe, and three 19-conductor cables of the usual iron wire armoring, making a total of 423 wires under the river. In applying the large cables the pipes were first put in position 3 ft. below the bottom and 35 ft. below high tide, and the cables then pulled through, especially long socket couplings being used on the pipes to guard against the accidental breaking at the threaded joint.

The switch mechanism consists chiefly of a sliding bar, which is attached to the piston of an air cylinder and made to engage a peculiarly shaped bell crank connected to the switch rails; the extreme end of this bar being connected by a horizontal lever to one or more detector bars. The bell crank operating the switch is not moved by the slidebar of the movement until the latter has moved a short distance, which movement withdraws a lock bolt from a hole in a bar secured to the switch points, thus making its movement possible. Its movement also ceases before that of the slidebar, the final movement of the bar being utilized to again lock the switch in its reversed position by a second lock bolt also mounted on the slidebar.

It is evident, then, that a complete movement of the bar itself must precede a complete movement of the switch at each operation, and that the complete movement of the slidebar insures the locking of the switch points in their proper positions; this is of the greatest importance, as upon it depends another feature of the system which is peculiar to it. Mounted directly over the slidebar is a box-like casting containing a circuit shifting device that is operated by the bar only after the lock bolt has entered the switch rod and locked it; this device is connected electrically with a similar device and an electro-magnet attached to the switch lever of the interlocking machine, and is used to electrically release the lever after the switch has responded to a previous partial movement of it, whereupon its complete movement may be made, and the proper signals thereby released.

The signal mechanism consists of a 3-in. cylinder mounted vertically upon the post in a suitable casing, and is provided with a valve chamber, and an electro-magnet controlling the valve thereof in its upper chamber, and a piston which is joined by a link to one end of the counterweighted lever, the other end of which is joined to the signal. When the magnet becomes charged by an electric current from the operating machine, it operates the valve so as to admit the air to the cylinder, which depresses the piston and elevates the weighted end of the lever and the signal rod, thus lowering the signal to the safety position. When the electric current is cut off the magnet releases the valve, and the air in the cylinder thereupon escapes, and the weighted parts of the signal restore it to the danger position.

There are at the terminal station side of the Charles River draw 72 signals and 36 single switches, 18 double slip switches and 4 movable point crossing frogs; and on the tower side of the river there are 43 signals, 11 single switches, 26 double slip switches and 13 movable point crossing frogs; or a total of 117 signals, 47 single switches, 44 double slip switches, and 17 movable frogs, besides the necessary detector bars, which aggregate in length 8,910 ft., all operated from the one machine in the tower.

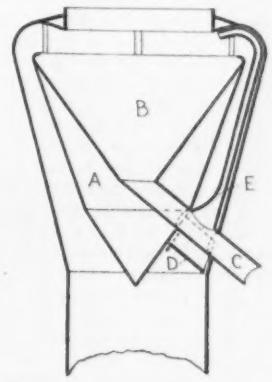
At Prison Point a similar machine of about three-fourths the size of the one at the terminal handles the network of switches and the many signals governing the traffic at this point, which involves the junction and crossing tracks of the Fitchburg R. R. with the Boston & Maine R. R.

A small electric lamp, instead of a bell, is now being used in telephone exchanges in various parts of the country The call for connection by a subscriber lights the lamp.

THE LEE SPARK ARRESTER FOR LOCOMOTIVES.

A spark arrester designed to operate exclusively by the deflection of the particles, without the use of any screen or netting, has been invented by Mr. Thomas Lee, of Cincinnati, O., and put in service upon a locomotive of the Cleveland, Cincinnati, Chicago & St. Louis Ry., and we are indebted to Mr. Schuyler Hazard, Assistant Engineer, for particulars of this device.

As shown by the accompanying cut, there are two concentric inverted cones, A and B, within the enlarged top of the stack, the inner cone, A, being shallower than the outer one, B. Sparks carried up the smokestack pass through the annular space around the cones and strike the curved upper lip of the stack with such force that they are deflected into the inner cone, where they are free from the



The Lee Locomotive Spark Arrester; C, C., C. & St. L. Ry.

force of the escaping steam and gases, and so fall to the bottom. A curved lip on the inner edge of this cone prevents sparks and cinders from being blown out when once within the cone. The space between the two cones forms an air space or may be filled with non-conducting material—its purpose being to prevent the exhaust steam striking the comparatively cold surface of the open cone, and thus avoid any water of condensation which would drop into the stack and tend to choke it with wet soot. The cinders can be discharged through the pipe, C, which has a deflector, D, on the under side, serving the same purpose as the outer cone, while a small pipe or flue, E, leading from this pipe, carries up to the top of the stack any vapor contained within the cone.

The locomotive upon which this device has been applied was used at first in switching service, with satisfactory results, and has been in suburban passenger service for nearly two months with equal success. Exhaust nozzles of different sizes have been tried, and the spark arrester gave good results in all cases. The nozzle is concentric with the point of the cone. It is stated that no loss in steaming capacity has been observed, but rather the reverse, and a marked saving in fuel is claimed to have been attained, but a longer period of service is required before the full efficiency of the device can be decided upon.

THE HUSSEY DELIVERING DREDGE.

(With inset.)

Where dredging operations are carried on in soft material (such as mud, sand and clay) for the purpose of deepening channels or filling in tracts of land, various methods have been employed for handling the material economically, and the most satisfactory results, especially for filling, have probably been obtained by pumping the material ashore through a pipe line which discharges on the site to be filled. In the majority of cases where direct pumping is employed, the pumps are of the centrifugal type, the principal exceptions being the Booth pump and the Hussey pump herein described. Reference may also be made to the Riker and Badger pumps, which, however, discharged into chutes instead of pipes. The three latter operate practically on the principle of the old Savery pump or the well-known modern pulsometer, the suction being

by means of a vacuum and the discharge by direct steam pressure on the contents of the pump chamber. The pump is also generally used to dredge or draw up the material by suction and then to force it ashore, the exceptions being the Riker and Hussey pumps.

In the Hussey dredge, the shore delivery of the material is an essential feature, but this feature is entirely independent of the dredging, the dredging apparatus merely dumping the material into a hopper or receiver, from which a pipe leads to the pumping apparatus. Fig. 1 represents a large dredge of this type which is now in use for filling in and reclaiming a large tract of land at Far Rockaway, N. Y., on Long Island. It consists of a large rectangular flat-bottomed hull, having at its front end two derrick towers, with braced booms, from which are suspended buckets of the "orange-peel" type, having four curved triangular sections. Behind the towers are the pumping plant and receivers. The series of operations may briefly be described as follows, the description referring to one of the two duplicate equipments with which the dredge is fitted: The bucket empties its load into a hopper, A, and when that is filled with the requisite amount of material to fill the pump, a vacuum is created in the cylindrical chamber, B (by a water spray condensing steam therein), so that when the steam-actuated valve, C, is opened the external atmospheric pressure drives the contents of the hopper forcibly through the inlet pipe, D, into the pump, filling it nearly to the top. The inlet valve, C, is then closed, and the steam-actuated outlet valve, E, is opened, while at the same time steam at 10 to 100 lbs. pressure (according to the elevation and the length of the delivery pipe) is admitted at the top of the pump chamber, driving the material out through the discharge pipe, F, the outboard end of which is supported by guys from an A-frame, and to this pipe is connected the shore delivery pipe. The steam used to expel the load is then condensed by a spray to form a vacuum to take in the next load or charge. Both pumps discharge into the same pipe, working alternately, so that the column of material is kept constantly moving. The dredge is held up to its work by spuds in the usual way. As already noted, the inlet and outlet valves are operated by steam, and the details of the valves and valve mechanism are shown in Fig. 2. The valves are of the gate pattern moving vertically, and should a stone or other obstruction lodge on the seat, it is driven out by raising the intake valve slightly and introducing a little steam pressure, which drives back the obstacle into the receiver, thus freeing the passage and allowing the valve to close. On emergency an obstruction wedged in the valve seat may be crushed by giving the valve a few rapid strokes. The valve casing is sectional, put together by bolted flanges so that renewals and repairs can be effected readily and promptly. The steam supply of the operating cylinder is controlled by a duplex piston valve, consisting of two concentric cylinders, H and I, with ports cut in the walls, and connecting with the ports in the cylindrical valve chest, G, as shown. All the valves are operated by one man, and there is one man to attend to the handling of each of the two dredge buckets.

The dredge now at work at Rockaway has a hull 120 ft. long, 55 ft. beam and 7 ft. deep in the clear, with a draft of about 5 ft. The radius covered by the two dredge booms is 150 ft., and the maximum depth of working is 35 ft. The buckets are of 4½ to 6 cu. yds. capacity, and the hoisting engines have cylinders 14 × 18 ins. There are four boilers 5½ ft. diameter and 16 ft. long, supplying steam for the hoisting engines and the pumps. The vacuum in the pump is about 28 ins. and the steam pressure varies from 18 to 35 lbs., according to the elevation of the delivery pipe. The hoppers are 15 ft. 6 ins. square, and 7 ft. deep, and the pump cylinders are 5 × 16 ft., with a capacity of 14 cu. yds. The suction, discharge and shore pipes are all 18 ins. diameter, and the valves give the full opening. At the time of our visit the length of the discharge pipe was about 2,500 ft., and the dredge was handling about 500 cu. yds. per hour, with the pumps making from 1½ to 2 strokes per minute. The material being handled was composed of sand, gravel and mud, about 70% being sand, and the discharge from the delivery pipe approximated about 50% of solid and 50% of water.

Work has been done at Newburg, Rye, Bergen Beach and Far Rockaway, handling sand, clay, mud and even rocks. Enough water is added to the material in the hopper to serve as a lubricant in passing through the pipes and to fill all interstices so as to prevent any loss of pressure. It is said that in mud the machine will handle 80% solid matter with 20% of water, or in sand 50% of solid material to 50% of water. Clean sand is expensive stuff to handle by centrifugal pumps, owing to its cutting action on the blades and casing, but it may readily be handled in the Hussey dredge. The first of these dredges was built under the direction of the Mining & Dredging Power Co., and operated under a license from the company by Babcock, Lary & Co., at Orange Lake, Newburg, N. Y., where the material was transported 2,500 ft. through 15-in. pipes, reaching an elevation of 44 ft., the material as delivered containing approximately 75% of solid and 25% of water. This same dredge has for a year past been doing successful and satisfactory work in handling pure sand at Bergen Beach, N. Y. The dredge referred to in this article was constructed later, and did its first work at Rye, N. Y., where it was required to handle gravel, stiff clay, sand, and stones which could scarcely pass through an 18-in. pipe, delivering these materials through 1,035 ft. of pipe and raising them 25 ft. in this distance. One of the many large stones was 16 × 21 × 10 ins., and was forced through with a pressure of 12 lbs. of steam. Large stones and other heavy articles can be passed without injury to the pipes. The machines are owned and operated by The Mining & Dredging Power Co., of 68 Broad St., New York, and we are indebted to Mr. John R. Stuyvesant, General Manager of the company, for drawings and photographs from which our cuts have been prepared.

The principles employed in this dredge are those embodied in the various patents of Edward D. Harsen and Levi Hussey, and now owned by the company, and the company also owns a patented system for the application of the vacuum pump to the combined operation of dredging and filling. The special features covered by the various patents owned by this company include the following: 1. The steam valve on the vacuum pump; 2. Combination dredge, elevating the material with any kind of elevating device, scoop, clam shell, endless chain, orange-peel bucket, etc., in combination with the receiver and a vacuum pump, the receiver being a regulator in which the material dredged is deposited and mixed to the proper consistency, and thence forced through pipes; 3. A vacuum pump, the intake and outlet valves of which are operated by steam, air, water or any actuating medium; 4. A vacuum pump in which the material is discharged by compressed air and the vacuum formed by the steam from the air compressor.

The type of dredge here described is comparatively inexpensive and there is but little machinery to get out of order, while suction dredges are usually very costly and require continual attention and extensive repairs to the pump, cutters, and the various gears and connections. Still another advantage in favor of the Hussey dredge is that it can handle and remove any heavy article that the bucket can get hold of, and that is not so securely anchored or attached as to overcome the hoisting capacity (which latter case would be extremely rare), while at the same time such bulky or heavy pieces need not go through the pump, but can be laid aside on the deck to be disposed of in some other way. It is claimed that this system of digging and filling is the most economical, expeditious, powerful and satisfactory of any system now in operation for removing large bodies of material and depositing the material at any required point. The system is adapted for dredging rivers and harbors and depositing the material on shore to make filled land, and also for cutting canals and waterways, and for recovering gold from gold-bearing river beds and submerged bars.

Where it becomes necessary to have the material delivered ashore of a special consistency, the dredge buckets and receivers are used in connection with this pump, as above described; but in dredges designed for handling gold-bearing gravel from the bottom of rivers and submerged bars, and where the quantity of solid to the quantity of water is of slight importance, the suction pipes are extended down to their work at the bottom of the water, thus dispensing with the buckets. Two years' working in placer mines in New Mexico have demonstrated the fact that the suction of this pump is strong enough to raise the gravel with the gold in it from under the water, whereas with almost any form of bucket for dredging such material a very considerable proportion of the gold will escape from the gravel and be lost, owing to the agitation of the gravel.

In the majority of cases where pumping is employed in connection with extensive dredging operations, but not in the case of the Hussey dredge (except when the latter is used for dredging in gold-bearing gravel beds, as above noted), the pump serves both to draw the material up through a suction pipe (whose mouth is close to the surface of the material) and to discharge the mixture of mud or sand and water through the shore delivery pipe. This involves the handling of great quantities of water. Mr. Webster, M. Inst. C. E., in a paper on "Dredging Operations and Appliances" (Eng. News, July 16 and 23, 1887), pointed out that while suction pumps have been used with very satisfactory results, yet they have the disadvantage (when used for ordinary dredging purposes) of taking up a large proportion of water, which means an extravagant expenditure of power for the pumps and a consequent large consumption of fuel for merely raising water. If this is pumped ashore it still further increases the cost of pumping, while in hopper dredges a considerable proportion of the contents of the hoppers will be water, which has to be carried out to sea and discharged with the solid matter. The proportion of water varies with the character of the material, but is in all cases large in order to prevent overloading the pump and choking the pump and pipes. When the end of the suction pipe is practially perpendicular to the surface dredged, the proportion of water can be regulated by skillful handling of the pipe, but this is difficult in deep water. In shallow work where an inclined suction pipe is pushed ahead of the dredge there is liable to be a greater and more irregular proportion, the breast against which the pipe works breaking down by the weight of the superincumbent water so as to leave the mouth of the pipe practically open, the pumps then drawing up principally water until the pipe again cuts a breast. Hence, by this system a considerable proportion of the fuel and power are expended in pumping and conveying water which serves no useful purpose. Where the dredging and pumping operations are independent, as in the Hussey dredge, the amount of water is regulated as required to suit the material handled.

MINERAL AND METAL PRODUCTION OF THE UNITED STATES IN 1893 AND 1894.

We present herewith, through the courtesy of our contemporary, the "Engineering and Mining Journal," a tabular summary of the production of minerals and metals in the United States in 1893 and 1894, compiled by Mr. Richard P. Rothwell, M. Am. Inst. M. E., for Vol. III. of "The Mineral Industry," the annual statistical supplement to the "Engineering and Mining Journal." The labor which is represented in the collection of the detailed statements from which this little tabular summary is prepared is enormous in amount, and we are informed that the compilers of these figures consider them the most accurate that have ever been presented of the production from the mines, quarries and metallurgical works of the United States.

It will be seen by the table that the net value of the country's mineral products was about 10% less in 1894 than in 1893; but this was due, it appears, not to a decrease in production as a whole, but to a decline in the market prices of the articles produced.

An interesting feature of the table is the figures given of silver and gold production. It will be seen that there has not been that large increase in gold production which the monometallists have confidently predicted; and, on the other hand, the great decline in silver production which the "free silver" party has asserted will follow the slump in price that took place in 1893, has not occurred. Gold production in 1894 was less than $4,000,000

MINERAL AND METAL PRODUCTION OF THE UNITED STATES IN 1893 AND 1894.
Compiled by Richard P. Rothwell, M. Am. Inst. M. E.

No.	Products.	Customary Measures.	1893. Quantity. Customary Measures.	1893. Quantity. Metric Tons.	1893. Value at Place of Production.	1894. Quantity. Customary Measures.	1894. Quantity. Metric Tons.	1894. Value at Place of Production.
	NON-METALLIC.							
	Abrasives—							
1	Corundum and emery	Short tons	1,747	1,585	$140,580	1,220	1,106	$109,500
2	Garnet	"	1,520	1,379	55,800	1,000	907	35,000
3	Grindstones	"	45,340	41,133	345,920	37,400	33,922	335,800
4	Millstones	"	155	141	2,350	297	269	4,447
5	Tripoli and infus. earth	"	1,351	1,226	25,625	1,802	1,634	36,687
6	Whetstones	"	1,908	1,726	80,550	1,735	1,574	84,420
7	Alum	"	96,000	87,093	2,880,000	2,000	65,304	2,160,000
8	Antimony ore	"	850	771	41,000	165	150	9,075
	Asbestos and Talc—							
9	Asbestos	"	120	109	6,000	250	227	3,750
10	Fibrous talc	"	36,500	33,113	337,625	39,000	35,917	396,000
11	Talc and soapstone	"	20,100	18,235	866,925	21,044	19,087	401,892
12	Asphalt	"	3,490	3,166	68,682	4,198	4,080	75,654
13	Bituminous rock	"	31,404	28,489	114,752	34,199	25,018	148,120
14	Barytes	"	26,632	24,161	183,160	23,758	21,548	95,032
15	Bauxite	Long tons	19,041	10,896	55,305	10,732	10,908	42,928
16	Borax	Pounds	9,199,000	4,173	689,925	18,140,589	5,962	919,841
17	Bromine	"	348,399	158	87,100	679,444	172	98,655
18	Cement, natural hydraulic	Bbls., 300 lbs.	7,445,950	913,677	5,010,958	7,895,250	1,074,179	4,397,407
19	Cement, Portland	"	673,989	91,715	1,052,173	738,190	100,352	1,080,644
20	Clay, refractory	Short tons	3,214,989	2,916,591	4,822,483	3,375,738	3,061,794	4,050,885
21	Clay, kaolin	"	30,183	27,382	205,667	24,552	22,346	185,169
22	Coal, anthracite	"	47,355,387	42,960,116	74,605,885	52,010,423	47,183,345	80,879,404
23	Coal, bituminous	"	a128,826,364	116,860,397	123,899,415	a117,950,348	106,953,311	103,842,467
24	Coke	"	8,939,961	8,104,202	14,706,544	8,495,295	7,706,846	12,654,598
25	Cobalt oxide	Pounds	3,894	2	5,452	6,550	3	8,843
26	Copperas	Short tons	17,862	16,204	134,520	14,897	13,511	104,160
27	Copper sulphate	Pounds	54,000,000	24,492	1,822,500	e60,000,000	27,215	2,016,000
28	Chrome ore	Long tons	1,029	1,046	16,000	2,653	2,697	35,135
29	Feldspar	"	17,000	17,274	85,000	23,280	23,655	116,400
30	Fluorspar	Short tons	9,700	8,800	63,070	9,000	8,165	64,000
31	Graphite	Pounds	882,912	400	39,731	770,846	349	34,689
32	Graphite, amorphous	Short tons	1,691	1,534	8,996	165	150	1,252
33	Gypsum	"	330,231	299,682	927,615	287,517	279,495	849,925
34	Lime	Bbls., 200 lbs.	e60,000,000	5,443,164	30,000,000	e56,750,000	5,104,355	28,375,000
35	Magnesite	Short tons	1,143	1,037	8,000	1,370	1,243	4,864
36	Manganese ore	Long tons	9,150	9,297	60,000	11,735	11,924	74,890
37	Mica, ground	Pounds	679,000	308	29,522	820,500	377	35,957
38	Mica, sheet	"	6,500	3	5,478	9,900	4	11,103
39	Monazite	"	130,000	59	7,600	750,000	340	45,000
40	Natural gas				14,000,000			11,000,000
41	Paints, mineral	Short tons	44,709	40,559	726,160	38,801	34,301	692,262
42	Paints, vermilion	"	37	34	40,000	41	37	45,000
43	Paints, white lead	"	88,500	80,286	9,469,500	87,242	78,155	8,445,174
44	Paints, zinc oxide	"	25,000	22,679	1,875,000	22,814	22,172	1,711,275
45	Petroleum (crude)	Bbls., 42 gals.	50,349,228	6,978,408	32,223,505	48,527,326	6,725,490	40,762,992
46	Phosphate rock	Long tons	981,340	997,140	3,434,690	932,155	967,485	2,856,465
47	Marls	"	200,000	203,814	540,000	225,000	228,622	607,500
48	Precious stones				200,000			220,000
49	Pyrites	Long tons	95,000	95,526	285,000	107,402	109,192	466,466
50	Salt, evaporated	Bbls., 280 lbs.	9,703,419	1,232,302	4,945,583	9,161,053	1,163,508	4,008,275
51	Salt, rock	"	1,935,642	245,898	678,064	2,341,922	297,438	788,681
52	Silica, sand and quartz	Long tons	300,000	304,814	330,824	315,531	320,610	347,951
53	Slate, roofing	Squares	803,887	237,014	2,926,895	693,944	204,656	2,551,259
54	Slate, other manufactures	Square feet	4,138,920		475,681	5,099,791		499,578
55	Soda, natural	Short tons	2,500	2,268	12,500			
56	Soda, natural sulphate	"	90	82	450			
57	Stone, limestone (flux)	Long tons	3,750,000	3,810,375	2,250,000	3,544,393	3,602,290	2,126,636
58	Stone, marble	Cubic feet	5,639,681	420,399	2,087,758	5,681,766	433,093	2,177,280
59	Stone, onyx	"	2,175	166	28,750	1,450	110	29,000
60	Other building stones				e38,000,000			e30,000,000
	Total non-metals				377,517,086			353,760,877
	METALS.							
61	Aluminum	Pounds	a312,000	142	202,800	817,600	371	490,560
62	Antimony	Short tons	350	318	63,000	220	205	39,200
63	Copper	Pounds	327,255,788	148,441	35,179,997	353,504,314	110,488	33,540,489
64	Gold	Troy ounces	1,789,325	*75,764	35,955,000	1,923,619	*72,732	39,761,205
65	Iron, pig	Long tons	7,043,344	7,156,782	93,888,309	6,657,388	6,764,572	71,966,364
66	Lead, value at New York	Short tons	166,678	152,080	12,434,178	160,867	145,906	10,585,048
67	Nickel, fine	Pounds	25,898	*11,745	12,429			
68	Quicksilver	Flasks, 76½ lbs	30,164	1,046	1,108,527	30,440	1,056	1,095,840
69	Silver, commercial value	Troy ounces	60,500,000	*1,881,550	47,311,000	49,846,875	*1,550,298	31,408,531
70	Zinc spelter	Short tons	76,255	69,178	6,214,782	74,004	67,135	5,309,882
	Total metals				232,370,022			194,092,119
	Est. products unspecified				6,000,000			5,500,000
	Grand total				615,887,108			553,352,996

(a) Including brown coal, lignite.
(e) Estimated.
* Kilograms.

greater than in 1893, and silver production fell off only 18% from 1893.

In the coal and iron trades, bituminous production fell off 9%, but anthracite increased 10%. In pig iron only about 400,000 tons less were produced in 1894 than in 1893, and the rate of production at the beginning of the present year promises to make its output equal that of the greatest year on record.

In using the totals given at the foot of the table, it should be remembered that some articles appear in the table twice—antimony, for example; and hence a certain deduction should be made to find the true value of all minerals and metallic products in the years named. The compiler of the tables has computed this deduction at $15,000,000 in 1893 and $13,000,000 in 1894. This would make the actual value of the production $600,887,108 in 1893, and $540,353,000 in 1894.

The bacteriology of water supplies is to be considered by a number of bacteriologists at the Academy of Music, New York city, on June 21 and 22. The meeting, we understand, is to be held under the auspices of the Committee on Water Supply of the American Public Health Association, of which Mr. Geo. W. Fuller, Biologist-in-Charge of the Experiment Station, Lawrence, Mass., is a member.

FREEHAND SLANTING LETTERING FOR WORKING DRAWINGS.

By Chas. W. Reinhardt,
Chief Draftsman, Engineering News.

In the following system of lettering no attempt has been made to imitate any special form of printed alphabet, and for all ornate and elaborate lettering the draftsman is referred to some one of the many published collections of this character. What is here intended is to illustrate and describe a type of lettering that looks well upon working drawings; is reduced to its simplest form; one that is rapidly made, and is clear and distinct under almost any reduction by photography. It is, in fact, especially designed for photo-reproduction. With the purpose of fairly treating the subject, the lettering here illustrated has been reproduced without any attempt at touching up or cleaning; it is actual freehand work, such as should be used in general practice.

In a future article the upright style of lettering will be described in considerable detail. When the draftsman becomes proficient in both these styles, he will find it easy to form satisfactory ornamental letters for himself. The first requisite is to produce sharp, clean corners and bold lines of uniform strength, and this is especially necessary in work for photo-reproduction, as all filled-in corners and uneven lines are greatly exaggerated on the plate.

In Fig. 1 the correct and incorrect methods are shown, and for the purpose of obtaining clean corners it will be well, at first, to resort to the

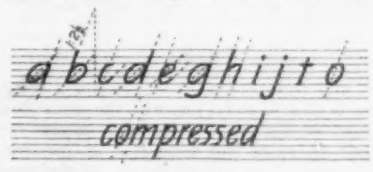


Fig. 1.

artifice of slightly curving the lines outwards at their ends, as exhibited on the third line of Fig. 1. For very large letters the writer finds a "ball-point" pen most satisfactory; for medium-sized letters, not less than 1½ millimeters high, either ters he uses Soennecken's No. 108,and for small-sized Gillott's No. 303, or Blanzy, Poure & Co.'s crow-quill pen. All of these pens should be "broken-in" somewhat before being used in lettering. As to type of lettering to be employed, the slanting letter is well adapted to descriptive matter, dimensions, etc., while the upright letter will contrast well with the other used as reference letters or sub-captions. A uniform pressure should be brought to bear upon the pen—a trick only acquired by practice. The pen should be held pointed forward, as in ordinary writing, and not sideways, as in "round writing." In lettering on tracing-linen a sheet of black cross-section paper placed unde. the linen will be found useful for giving the proper spacing, slant, etc. On drawing-paper, pencil lines will be indispensable to the beginner.

A slope of 1 to 2½ is sufficient for the stems or down-strokes of the letters, and ordinarily an angle of 45° with the horizontal will suffice for the up-strokes and the axes of ellipses, excepting that of the letter o. This latter angle will have to be increased, of course, when the lettering is compressed, as shown in Fig. 2. In lower case letters,

Fig. 2.

like b or p, with parts extending above or below the main body of the letter, the length of these parts should be about 2-5 the total height; the body of the letter representing 3 parts of the total height. The exception is the lower case t, which is 1 part less in total height than the b or h, for example. In the illustrations following, the incorrect formation of a letter is shown in brackets, with the correct method of forming the letter beneath.

The letters n and m, Fig. 3, should be made with

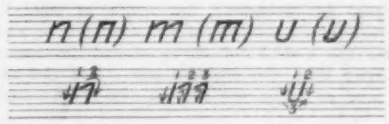


Fig. 3.

almost sharp upper corners; u is best formed by three strokes, as in this way parallel positions are secured for the straight lines, which should be made

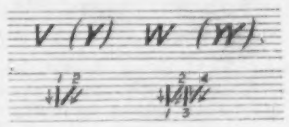


Fig. 4.

first, and these can be then joined by a lower curve. In forming the letter v, Fig. 4, make the first

stroke nearly vertical and the second at an angle of about 45° with the horizontal. The common error in making this letter lies in curving the two lines and giving the letter the appearance of a y. The letter w is formed on the same principle as the v. In putting in the short horizontal cross-line of the t, Fig. 5, great care should be taken to use

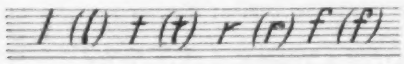


Fig 5.

very little pressure upon the pen, as otherwise the ink will spread at the intersection of the two lines and make clean corners impossible. The second part of the letter r should be purely an up-stroke, slightly curved at its end. In making the letter f, start with a curve extending down one space; the f shown in brackets would come out with a heavy black knob at top in any considerable reduction. The rule laid down for forming the n may

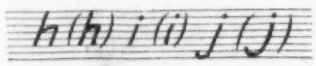


Fig. 6.

also be applied to the letter h, Fig. 6, and the down-stroke for the j is practically the same as for the f reversed. Make bold, oblong dots over the i and j.

The third stroke of the letter k, Fig. 7, should be vertical and begin at about the middle of the

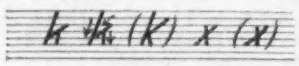


Fig. 7.

second stroke. In constructing the letter x, care should be taken to have the first stroke either vertical or leaning slightly backwards, and the second stroke ought to cross the first a little above its center; in order to produce a clear intersection, it may be well to make the latter stroke in two parts. The letter y, Fig. 8, should be drawn on the lines

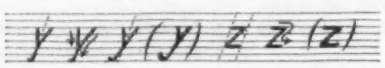


Fig 8.

of the v, and from the point of the angle the tail should be drawn in exact line with the upper down-stroke, terminating, if desired, in a slight curve to the left to avoid the little blot of ink which would otherwise form at the bottom of the stroke. In this letter the second stroke may be modified as shown. The z is best drawn in one stroke, stopping the pen every time before changing direction. The letter o, Fig. 19, is made by two curved strokes forming an ellipse, the axis of which lies in the direction of the down-stroke. The joining of these two curves, in this and similar letters, can be effected very neatly after a little practice.

The ovals of the following letters should be made somewhat narrower at the top than at the bottom, for obvious reasons; and especial care must be taken to have the axis of these ovals lie at an angle of 45° with the horizontal. For the purpose of increasing the width of the enclosed space at the bottom of the down-stroke and the oval, the right-hand curve should be somewhat flatter than the opposite one. For the advantages of so doing, see Fig. 9. In these letters

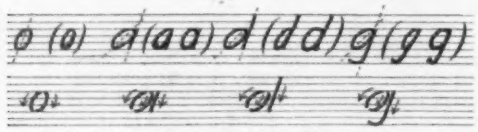


Fig. 9.

the down-stroke should be at exactly the proper angle, rather increasing this angle at the beginning, for the learner almost invariably makes the mistake of drawing this stroke too slanting. To further guard against this error, the beginner may slightly curve the down-stroke towards the left, thus widening the angle at the bottom of the a and d, and the down-stroke of the g should be made as long as possible in its straight part by turning very short with the lower

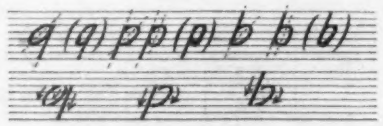


Fig 10.

left-hand curve. The letters p and b, Fig. 10, should be shaped exactly as inverted letters d and q. With practice these letters can also be made to look well by using the oval of the letter o.

The letter c, Fig. 11, is formed with one stroke, care being taken to have its general direction

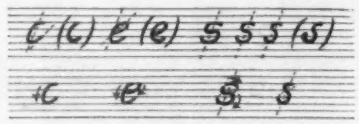


Fig. 11.

parallel to the down-stroke. The e is commenced in the same way, and the upper loop is formed by a second stroke with the axis of the loop again at an angle of 45°. The beginning of the s is a very short curve from left to right at its apex; the rest is carefully joined on, turned down into a neat ogee curve and finished by a little crook upwards. The middle part of this letter should be nearly horizontal.

Capital Letters.

As in the rule laid down for the lower case letters, the capital letters will generally be five spaces high. Sharply defined, clean corners are again necessary, and to secure this the beginner may find it advantageous to curve the upper and lower ends of the down-strokes a little outwards.

The letter A, Fig. 12, should be made in three strokes, with the second almost vertical. The

Fig. 12.

cross-stroke should be placed low—about the middle of the second space from the bottom. The short third stroke of the E should be slightly above the center of the letter, and should not be too short. The two down-strokes of the letter H, Fig. 13,

Fig. 13.

should be exactly parallel, and the horizontal stroke should be made as directed for the third stroke of the E. If the capital I is to be followed by a lower case l, two short horizontal strokes of even length and projection may be added to the top and bottom. The second stroke of the letter K should join the first at the top of the second space from the bottom, and the third stroke should join the second nearly one space higher up. The letter L can easily be made with one stroke, analogous to the forming of the same stroke of the letter E.

The J, Fig. 14, is commenced as a perfectly straight down-stroke to the top of the lower space;

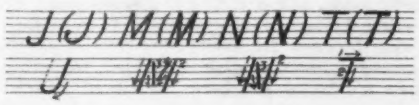



Fig. 14.

then it turns to the left in a gentle curve, tangent to the base line, and finally rises to the top of the first space. The M is made with four separate strokes, putting in the two parallel lines first; the two other strokes should join at the top of the first space. If desired, this letter may be made slightly wider at the bottom than at the top. The letter N is also formed by drawing the two parallel strokes first. The horizontal stroke of the T should be neatly balanced on top of the down-stroke, and if it is not perfectly straight, as often is the case, a hardly noticeable crook downwards at both ends will improve it.

The letters shown in Fig. 15 are to be constructed precisely upon the lines laid down for the

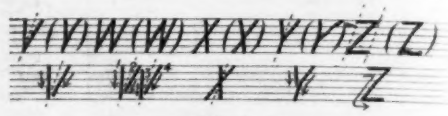


Fig. 15.

corresponding lower case letters, with the exception that they should be a trifle narrower in proportion. The Y is formed with two strokes without any lower crook to the left; the Z is made in one stroke, with the axis of the letter on the direction of the down-stroke. If found easier, this Z can be made with three strokes. With practice the letters P, B and D can each be formed with two strokes, with the curves terminating as shown. In forming the two curves of the letter B, begin at the top, and after joining the stem, return exactly on the horizontal while the ink is yet moist

Fig 16.

and complete the lower curve. The space enclosed by the lower curve should be somewhat larger than that in the upper one. The curve of the D should be parallel with the down-stroke in its middle third, but it may sometimes be advisable to make the lower part of the D a shade wider than the upper part. The first and second strokes of the R are identical with the letter P, and the third stroke, or tail, should be made as shown.

The C, Fig. 17, is formed with one stroke, nearly completing the ellipse of the letter O, though this

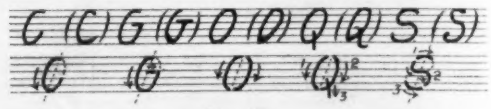


Fig. 17.

letter is proportionally narrower than the lower case c. In making the G, a somewhat wider ellipse is required, and this letter is most easily made with two strokes; the second horizontal stroke should be about one-half of the total width of the ellipse. The capital O should be an almost perfect ellipse, special care being taken in joining the two curves. The third stroke of the Q should begin about the middle of the second space, and extend one space below the base. The letter S can be formed for small-sized lettering in two strokes, or with an additional stroke, as shown, for larger letters. In this letter the axis of the two ellipses should be horizontal.

Arabic Numerals.

As a rule, numerals should occupy the same height as capital letters, or five spaces, though the use of fractions may slightly modify this rule. When the numeral 1, Fig. 18, is used in proximity with

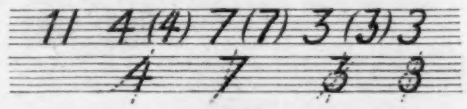


Fig. 18.

I or l, it is well to use a short up-stroke at the top; otherwise, it may be represented by one bold down-stroke. The 4 is commenced with the stroke inclined at an angle of 45°, terminating at the second space from bottom and then turning sharply into the horizontal. The down-stroke should intersect the horizontal in such manner as to leave 3-5 of the horizontal to the left of the down-stroke. The 7 is best formed with one stroke, the down-stroke being on an angle of 45°. The 3 should

be drawn in one stroke, beginning as with the 7 to a point a little below the top of the third space, and then curving into a portion of an ellipse, with an axial angle of 45°. Another type of the numeral 3 is shown, which can be made in one stroke also.

The 0, Fig. 19, ought to be a perfect ellipse, like

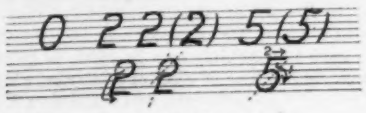


Fig. 19

the capital O. The 5 is commenced with the down-stroke, ending in the ellipse of the 3 and the horizontal upper stroke. The 2 can be constructed by one stroke, beginning at the top of the fourth space, nearly completing an ellipse with an axial angle of 45°, and then turning shortly into a down-stroke, running to the base line, and sharply turning into the horizontal. The figures 5 and 2 should not lean too far to the right. The 6, Fig. 20, is

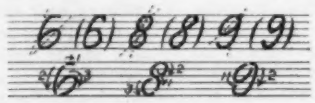


Fig. 20.

commenced like the 0, except that its initial point is somewhat beyond the axis of the ellipse. For that reason the first stroke is very short, curving to the right; the second stroke descends nearly to the base, where a stop is made, and the pen then returns in the same stroke, and, gradually turning to the right, nearly completes an ellipse and joins the lower part in a short curve. The figure 8 is commenced with an ogee curve, using a slight crook at its lower end, and is joined by two other curves, as shown. The lower loop should always be somewhat larger than the upper one. The 9 is made with two strokes, the loop at the top being made first. As a certain element of roundness is requisite at the junction of the ellipse and the curved down-stroke, the proper formation of this figure requires two strokes.

Roman Numerals.

Though Roman numerals are seldom employed on working drawings, they may sometimes be required. The chief requisite is to so form them that they are neat in appearance and easily distinguished from the rest of the text. They should

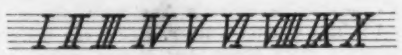


Fig. 21.

be of the same height as the Arabic numerals, and short horizontal strokes should be used with them, as indicated in Fig. 21.

Modified Lettering and Numerals.

In the modified forms shown in Fig. 22 it will be noticed that all the letters and numerals are

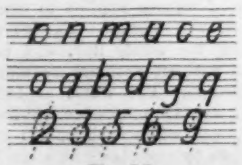


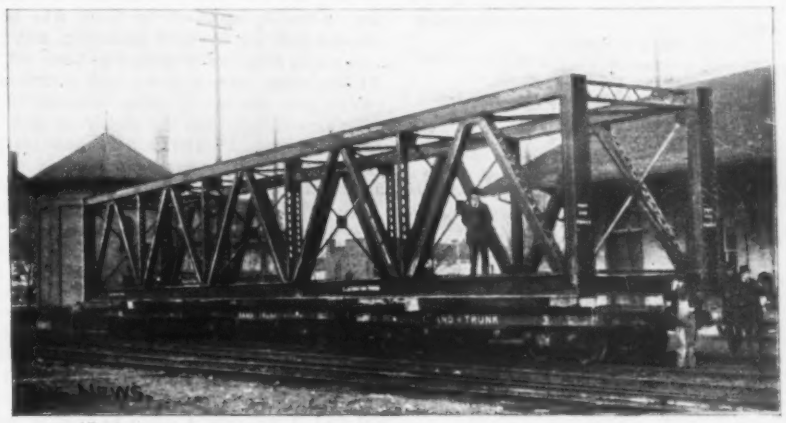
Fig. 22.

based upon the general form of the letter o, modified to suit demands. The second stroke of the r is really a part of the elementary ellipse, as are also the second stroke of the n and the second and third strokes of the m. The u is here made in two strokes—the first, a down-stroke with the curve attached, and the second a straight down-stroke, tangent to and touching the curve.

The numerals follow similar lines of construction. The 2 begins at the upper part in an ellipse and ends in a down-stroke, laid at an angle of 45°, turning sharply to the right in a horizontal line. The 3 is formed with one stroke with its lower curve, as also that of the 5 and 6, encircling somewhat more than half of the ellipse. In the 6 and 9 care must be taken to have the down-stroke tangent to the curve.

SHIPPING A 90-FT. SPAN BRIDGE BY RAIL.

The shipment by rail of bridge girders and even bridge trusses completely erected has become so common in recent years that it attracts but little attention, but so far as we know the shipment of a 90-ft. span railway bridge intact, ready to be set on the masonry is something new. This has recently been done by the Central Bridge & Engineering Co., of Peterboro, Ont., in the manner shown by the accompanying engravings. The dimensions of this bridge were: Length over all, 90 ft.; height of trusses, 12½ ft.; width over all, 11¾ ft. The iron-work was designed according to the Dominion Government specifications for railway bridges, viz.: Dead load, 1,300 lbs. per lin. ft.; live load, 4,000 lbs. per lin. ft.; stresses in tension in pounds per square inch, bottom chords, 10,000 lbs.; diagonals, 9,000



VIEW OF 90-FT. SPAN FOR THE IRONDALE, BANCROFT & OTTAWA RY., LOADED ON CARS FOR SHIPMENT. Central Bridge & Engineering Co., Peterboro, Ont., Builders.

lbs.; laterals, riveted, 15,000 lbs., and stresses in compression according to formulas, for girders,

$$1 + \frac{\frac{10{,}000}{l^2}}{a\,r^2}$$

and for laterals,

$$1 + \frac{\frac{15{,}000}{l^2}}{a\,r^2}$$

where l = length of member in inches, and r = least radius of gyration.

The bridge was built for the Irondale, Bancroft & Ottawa Ry. In a letter from the builders, the method of transportation is described as follows:

> This bridge was finished complete in our girder shop and was loaded onto three cars and shipped to its destination in the manner shown in the photograph, the distance by railway being about 70 miles over a very crooked line. It arrived at its destination uninjured. The finished weight of this bridge was 65,000 lbs., and we believe it to be the largest and heaviest structure of the kind ever shipped intact in this country. We are prepared, however, to ship structures of this class up to 120-ft. spans. The method of loading was as follows: Bunks were secured to the platforms of the first and third cars, and a sliding plate was bolted at one end of each bunk on the top. These plates were well greased before the girder was loaded onto them. The girder rested on these wooden bunks. The bridge was prevented from moving laterally by blocks bolted between the chords. When leaving our works the bridge had to pass around a curve of about 12°. After passing onto the main line track we found that the bridge had not moved on the fixed end of the bunk. The cars curved readily, the girders sliding upon the greased plates very smoothly. We find that this method of securing the bunks to the cars and placing plates on the top at opposite corners works better than pivoting the bunks at the center.

An article on the best method of loading large girders for shipment by rail was published in Engineering News, Jan. 9, 1892.

VIADUCT SUBSTRUCTURE; KNOXVILLE, CUMB. GAP & LOUISVILLE R. R.*

By Gustave R. Tuska, Jun. Am. Soc. C. E.

The Lonesome Valley viaduct on the Knoxville, Cumberland Gap & Louisville R.R. is about 800 ft long, with maximum height above valley of 135 ft, and located about 60 miles from Knoxville, Tenn. It was designed by Wm. B. Parsons, M. Am. Soc. C. E., and consists of a single-track steel viaduct of 14 30-ft. and five 70-ft. deck spans, the 70-ft. spans being latticed girders and the 30-ft. spans plate girders. The towers are of the ordinary type, in which all connections are riveted. Beside the two abutments, there are 36 piers on which these towers rest.

On account of the poor quality of the only available stone for masonry, the bids for which varied from $12 to $16 per cu. yd., it was decided to use Portland cement concrete for all of the substructure, as this could be let by contract for about $7 per cu. yd. No derricks being necessary to place the concrete, steel plates were substituted for bridge seats and cap stones; ¾-in. plates for the former and ½-in. plates 4 ft. square for the latter. Common labor, costing only $1 per day of 11 working hours, was employed in placing the concrete.

The south abutment is 26 ft. high above the foundation, and 25 ft. long at the bottom of the face, with wing walls each 28 ft. 6 ins. long on top. The north abutment is 27 ft. high above the foundation, 26 ft. long at the bottom of the face, and the wing walls are 26 ft. 6 ins. in length at the top.

A batter of 1 in. to the foot was used on the faces and sides of the abutments, finished to a thickness of 5 ft. at the bridge seat, and 3 ft. 6 ins. at the top of the wing walls. The piers are each 4 ft. square on top, with a batter on the four sides of 1 in. to the foot, and vary in height from 5 to 16 ft. In most cases limestone rock was found at a depth of from 4 to 12 ft. below the surface of the ground, and in these cases the batter of 1 in. to the foot gave a sufficient area for the base of the piers. In some of the piers, however, rock was not found at a reasonable depth, and a good earth foundation was used, the dimensions of the bottom being increased so that in no case should the maximum pressure be greater than 1 ton per sq. ft. Pockets of clay were found in the foundations in several places, and this material was excavated and the pockets filled with concrete.

The molds were of 2-in. tongued and grooved plank braced by 2 × 10-in. plank, built in place. For the piers, a square frame was dropped over the molds and spiked to the posts. With the abutments, the molds were built up as the work of laying the concrete progressed. Their inside surface was painted with a thin coat of crude black oil. As the batter was the same on all the piers, by the addition of a few planks to the bottom of a mold it was possible to use it for a number of piers. In the case of a foundation on earth, the pier was built in two parts, the upper portion with the same batter as other piers, and the lower with a sufficient batter to give the required area of foundation. Concrete was mixed in the proportion of 1 part of Atlas Portland cement to 2 of sand and 5 of broken stone. Wooden cores had been placed in one case in the concrete on account of the delay in receiving anchor bolts. When the abutment was completed, these cores were withdrawn and the holes filled with water, and covered with boards and twigs, and after the concrete had set well it was found that the difference in the levels of the water from day to day was not noticeable, showing that the concrete was practically impermeable.

It is stated that 16 men forming a gang mixed and deposited in place about 40 cu. yds. of concrete in a day's work of 11 hours. One cubic yard of the concrete, well rammed and set, was made up of 1.25 barrels of cement, 10 cu. ft. of sand and 26.5 cu. ft. broken stone. One of the abutments contains 320 cu. yds. of concrete, and it was found advisable to build this mass in sections, so arranged that one section would overlap those previously built. The total amount of concrete in the 36 piers and the two abutments was 926 cu. yds.

* Abstract of a paper to be presented at the annual meeting of the American Society of Civil Engineers, at Nantasket, Mass., June 18 to 22.

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A concrete illustration of the financial straits in which many great railway corporations are now laboring is furnished in connection with the work of grade crossing removal at Buffalo. At a recent meeting of the Commission in charge of the work, the New York, Lake Erie & Western and the Western New York & Pennsylvania railways presented letters asking that the city loan them the money necessary to pay the cost of that part of the work which has been allotted to them. The first-named company offered to repay the loan in 20 years, and the other company was willing to bind itself to do so in 15 years. It is very much to be doubted whether the request will be granted. Even if the city officials were so disposed, it is doubtful whether the city charter would permit the city to loan money to a railway, even if it had a surplus to loan, and, as a matter of fact, it would doubtless have itself to borrow the money to loan to the railway. While a man of wealth and abundant credit can often make great profits by borrowing money at low rates of interest, and loaning it again to those whose credit is so poor that they are obliged to pay a high rate of interest, it is manifest that a city has no business to undertake such operations. It probably could not do so in any event without special enabling legislation, and it is not likely that such legislation could be secured.

On the other hand, it would be an object lesson of no small value could the case be presented to the legislature and be thus brought to general public attention. It needs just such concrete cases as this to hammer into the brain of the average voter, and especially of the average railway employee, the plain fact that a railway corporation cannot spend money unless it has money to spend or the credit to borrow it, no matter what demands may be made by labor unions, legislatures or courts.

We apprehend, indeed, that the time is not far distant when railway officials will have to present just such plain facts as these before the courts and the legislatures in the endeavor to avert further wiping out of the value of railway investments. And it must not be forgotten, either, that popular education on this matter is a necessity to prevent undue pressure of public opinion being brought to bear upon courts and lawmakers. This matter of grade-crossing removal is one that appeals especially to the popular mind; its necessity is being generally recognized by all progressive railway officers, and it is also seen that in many cases the saving in the annual cost of guarding grade crossings will go far to pay a good income on the cost of the work. But all such improvements require a heavy investment; few or no railway companies nowadays have surplus earnings from which they can take the money for such improvements, and in practically every case the money must be borrowed. If no one will lend the money, what are the railway officials to do? It is just as easy to extract blood from a turnip as to force a man or a railway to spend money when they have none.

The paper describing a system of lettering for working drawings, which is published on another page of this issue, treats of a subject to which too little attention is paid by the average draftsman, and, as a result, it is the exception rather than the rule to see good lettering on working drawings. It is true that the ability to do good freehand lettering is readily acquired by those who have some natural gift for freehand sketching, and is a difficult art to acquire for those who have not this gift. At the same time, patience and perseverance will enable any one to do plain freehand lettering in satisfactory style, and the ability to do it is worth far more to a draftsman than proficiency in the laborious and time-destroying work of copying ornamental letters from printed books of alphabets.

We would call especial attention to the importance to every draftsman of skill in making plain and neat figures. In these days, when the dimensions on a drawing are considered as instructions to the shop in most manufacturing establishments, figures that cannot be mistaken are insisted upon by every head draftsman, and with good reason. The figures illustrated in the article elsewhere are conspicuous for their legibility; and many draftsmen who have a habit of making figures with needless ornamentation will find it well worth while to acquire proficiency in making the simpler and neater system.

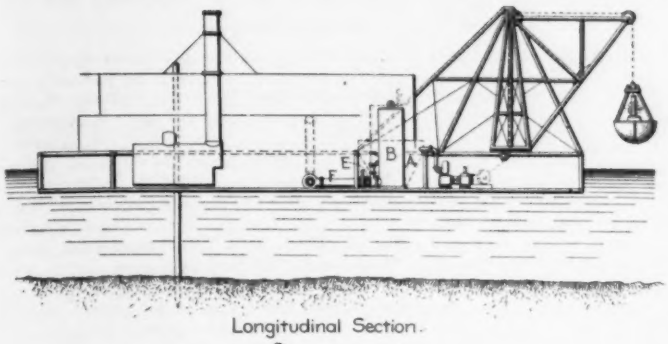
We may also call attention to the fact that the system of lettering which we illustrate has been especially designed for use in making drawings for photographic reproduction, and it will therefore be found exceedingly advantageous where the system is pursued of making a photograph of the original drawing for use in the field or the shop. The difficulty in handling large blueprints on erection work in the field, or even in the shop, is well known. In a windy or rainy day, on a bridge erection job, for example, it is no small task to unfold and examine a large blueprint. On this account many concerns nowadays are making reduced photographs of large tracings. With such a system of lettering as that in use by this journal, carefully executed, a tracing measuring 27 × 36 ins. can be photographed on a 9 × 12-in. plate, and the workman will find the reduced photograph far more convenient to work from than a full-size blueprint. The photograph can be mounted on cardboard and varnished, and will then last an indefinite time, no matter how many greasy hands it passes through. The legibility of good lettering when photographically reduced is already familiar to our readers by our inset sheets, which are, as a rule, drawn originally from two to four times the size which they finally appear, and are reduced by photo-lithography.

At the recent meeting of the Iron and Steel Institute of Great Britain, President Dale, in his annual address, reviewed the progress made in the iron and steel industries in the last quarter of a century. Incidentally he noted the very marked decrease in the cost of production during this interval, as a result of the wonderful discoveries of Bessemer, Siemens, Thomas and Gilchrist, and the host of others who have worked so well in the interests of the ironmaster. In 1870, 25 years ago, the relative merits of wood and iron in shipbuilding were still debatable topics, and steel was barely used at all for this purpose. Yet, thanks to the men named above, the progress in the manufacture and use of both was so rapid that in 1879 88 per cent. of the total tonnage launched in the United Kingdom was of iron, and in 1893 96 per cent. of the total shipping output was of steel. The price fell with the increased facilities for manufacture; in 1870 steel ship-plates cost $90 to $100 per ton, and ten years previously they cost $200 per ton. The present price is about $23.60 per ton, or practically the same price as iron plates in England. The production of steel rails has a similar history, and in this interval the English price fell from $55 to $17.40 per ton. In blast furnaces, where 400 tons a week was formerly considered a good output, 1,500 tons, and in the United States, 2,367 tons have been turned out from one furnace in one week. The progress of these industries has been more marked in the United States than in England in the period covered by President Dale's remarks.. Our production of pig iron, for example, rose from 1,665,179 tons in 1870 to 9,202,703 tons in 1890; in 1870 we only made 68,750 tons of steel of all kinds, while in 1892 we made 4,927,581 tons, and make over 4,400,000 tons now; and our steel rail output, which was 30,375 tons in 1870, was 2,119,049 tons in 1887.

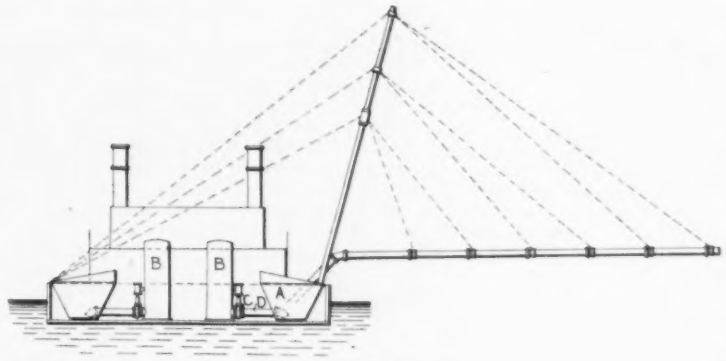
This phenomenal growth in the production of iron and steel has naturally been followed by a resultant cheapening of all manufactures into which these metals enter. But in other directions other discoveries and new processes have also had their effect upon production and prices in the period in question. Electricity, in its present wide application as a source of power, light and heat, has had its entire commercial development well within the last 20 years. The extension of railways and steamship lines, the increased carrying capacity of railways and steamers, and the opening of the Suez Canal and other shorter routes of communication all tend to cheapen the cost of transportation and the price of commodities of all kinds, and so narrow this world of ours as to bring its markets into closer competition than ever before. The producing world is now closely tied together by bonds of steel, by rails and by ships; and the discoveries and inventions which cheapen production in any one part of it are soon felt in some measure in all other parts. This unity of interests, causes and effects must not be overlooked when discussing economic conditions in our own country at the present time; for prevailing conditions have changed radically in the United States and throughout the world since 1870, and this change must be realized and our practice adjusted to it. Since the date in question, wide areas of hitherto unworked lands have been thrown open to the traders and producers of the world in our own Trans-Mississippi states, in Africa, in South America, in Siberia, and, last of all, in the Far East. The emergence of Japan from the position of an isolated, non-trading kingdom to that of a first-rate power with enormous productive capacity on most modern lines is an event of the last 25 years, and the effect of this new birth upon the older manufacturing nations of the West cannot be measured or even estimated. In fact, the world's productive capacity has been vastly increased in this quarter-century, and it can not only manufacture more goods, but it can make them cheaper, thanks to the machines born of new discoveries and the development of new ideas, resulting from a broader understanding of the forces of nature and the means of utilizing them for the purposes of mankind. No man can now set a limit to this advance in knowledge or measure its ultimate influence upon the nations of the earth taken as a whole. Under these conditions no idle vaporing or crude theories of finance applied to one section of the world alone will prevail. The advance is being made along the whole line, and no one part can lag behind without national disaster or loss of power and prestige. The world of 1895 is practically a unit, as far as production and markets are concerned, and while each nation can slightly modify conditions by such laws as seem best for its individual profit, it will not do to drop too far out of step with the rest, or venture upon crude experiments in national finance or currency inconsistent with the practice of the majority of nations.

THE HANDLING OF DREDGED MATERIAL.

In dredging work one of the most important points to be considered for the economical prosecution of the work is that of the handling and disposal of the dredged material, and this is, of course, more especially the case where the machine is at a distance from the place where the material is to be deposited. Even where the material is to be deposited near the work, however, as in canal and ditch excavation or in dredging at shore lines, some means of conveying the material from the dredge has usually to be adopted, it being rarely the case that it can be deposited directly and finally by the dredge bucket.

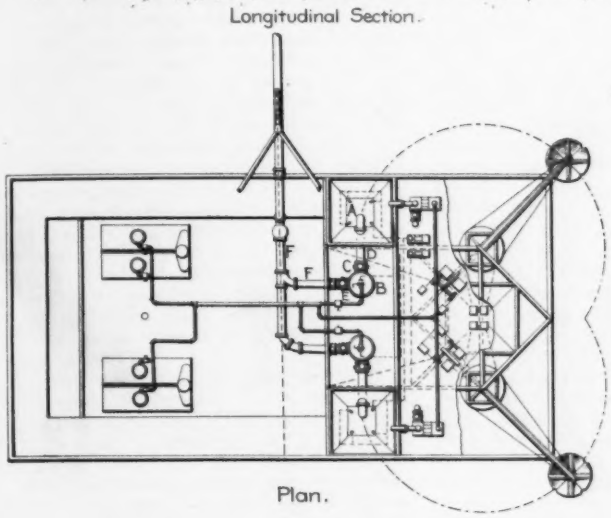


Longitudinal Section.

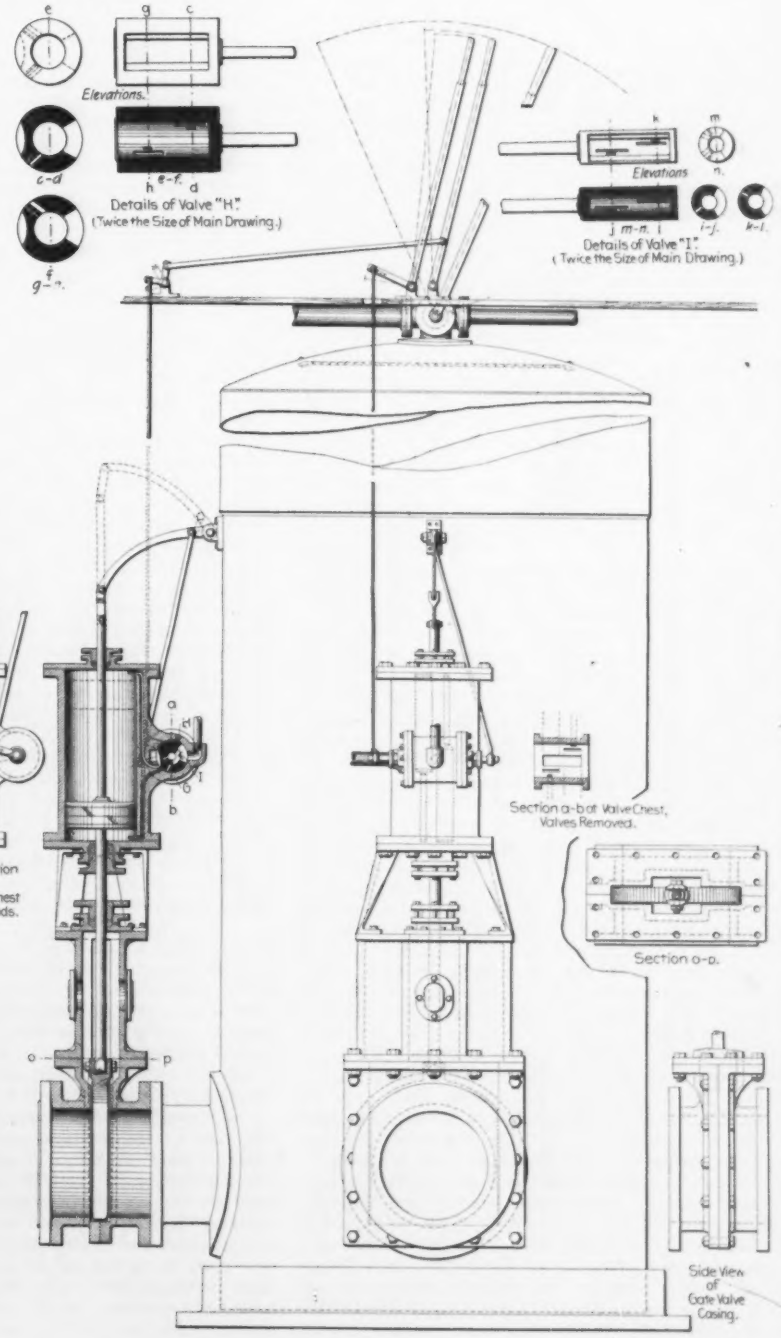


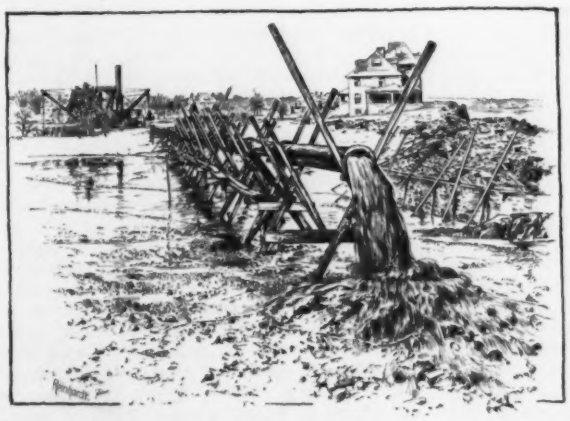
Transverse Section.

Plan and Sections of Dredge.



Plan.


Elevations.
Details of Valve "H."
(Twice the Size of Main Drawing.)
Elevations
Details of Valve "I."
(Twice the Size of Main Drawing.)
Elevation of Valve Chest and Rods.
Section a-b at Valve Chest, Valves Removed.
Section o-p.
Side View of Gate Valve Casing.



View of End of Delivery Pipe.

View of Dredge in Operation

Details of Pump.

The Hussey Delivering Dredge.

Mining & Dredging Power Co , New York.

Such direct depositing, however, is carried on to some extent (mainly on irrigation canal work) with dipper dredges having booms 70 to 80 ft. long, which dump the material from the buckets directly upon the adjacent land. In the large majority of cases, however, the material has to be carried from the dredge to the place of deposit, and some arrangement must therefore be made auxiliary to the dredging operations proper.

The most common practice is to discharge the material from the grapple or buckets into scows or barges, and for deep-water work, or where the material is to be carried out to sea, large dump scows are used, or hopper dredges, these latter being large steamers fitted with dredging plant and propelling machinery, and having hoppers formed in the hull. In canal work various forms of carriers and conveyors have been used for depositing the material beyond the banks, while for filling-in purposes very satisfactory results have been obtained with long lines of delivery pipes, through which the material is forced by pumping. Not only must attention be given to securing the most suitable and economical method of handling in any particular case, but care must be taken to ensure the proper distribution of the material, so that no additional shoveling, etc., will be required at the place of deposit, and also to prevent (by bulkheads, walls, or other means) the material from being washed or carried back into the dredged channel.

The different systems of handling the material may be classified as follows: 1, By cars; 2, By scows; 3, By hopper dredges; 4, By carriers or conveyors; 5, By pipes and chutes; 6, By direct pumping through discharge pipes to a considerable distance. There are various modifications and combinations of these systems, and they may be worked either in conjunction with, or entirely independent of, the dredging plant itself. Thus, in many suction dredges the pump acts both as a suction and a force pump, while in other cases the dredge boat has a dredging apparatus and an independent pump for sending the material ashore. On the other hand, at the North Sea & Baltic Canal the scows were towed from the dredges to an independent delivering plant, consisting of two barges, side by side, connected by heavy girders, and at such a distance apart as to admit the scow between them. One barge carried an engine driving a ladder dredge, which emptied the scow, the buckets delivering into the hopper of a chute carried by the other barge, the chute being inclined 5 per cent. and leading to the shore. On some of the river work in Holland, and on the improvement of the Sulina branch of the Danube, a delivery plant consisting of a suction pipe, a centrifugal pump and a long discharge pipe, was established on the shore, and the scows were towed down from the dredges to this plant. A somewhat similar system employed to some extent in this country is to use a hoisting dredge to empty the scows, and then force the material through pipes by a stream of water.

The first two systems of transporting the material —namely, by cars and scows—are perhaps the simplest, so far as the machinery employed is concerned. The material is delivered direct from the dredge, and the cars and scows are hauled away as required. Good judgment and systematic operation are essential to steady and economical working in either case, so that the dredge may not have to stop work and wait for the transporting plant; and, on the other hand, so that the dump cars or scows, with their crews, may not waste too much time in waiting for a load. In the first system, where cars are used, the methods do not differ essentially from those for handling material excavated by steam shovels, as described in Mr. Hermann's book on "Steam Shovels and Steam Shovel Work" (reprinted from Engineering News, 1893). In regard to the second system, scows are awkward and inconvenient to handle, and there is often serious interruption in the supply, and delay in getting the scows into position, while in rough water it is difficult to keep them in position. The scows may be unloaded by shoveling or by a special plant, as above noted, or they may be towed to shoals or deep water and dumped. The scows sometimes carry separate bins of hoppers, which are hoisted and dumped by a shore unloading plant.

In the third system, by the use of hopper dredges, the material is dredged by suction pumps, clamshell buckets or an endless chain of buckets, and discharged into hoppers in the hold of the vessel. The vessel carries its own dredging plant and is usually fitted with propelling machinery, so that when the hoppers are full it can go out to sea and dump the material at a specified distance. This system is largely used in harbor work, and one of the best examples is afforded by the work for improving the deep-water ship channels in the lower bay at New York. Previous to the adoption of this system trials had been made of two water-jet systems by Mr. Roy Stone, but these were unsuccessful, as the current did not carry the sand thus disturbed very far beyond the jet. Another contractor tried clamshell dredges, but it was found impracticable to keep the scows alongside. The work was finally done by hopper dredges, fitted with Edwards' centrifugal suction pumps (Eng. News, March 19, 1892, and Trans. Am. Soc. C. E., December, 1891). There were three steamers, with hopper capacities of 275 cu. yds., 500 cu. yds. and 650 cu. yds., the largest vessel being 157 ft. long, 37 ft. beam and 16 ft. deep in the hold, and being propelled by twin-screws and compound engines. The suction pipes were 15 to 18 ins. diameter, and about 60 ft. long, with a flexible section to allow for the motion of the steamer. The pipes were kept at an angle of about 30° to 40° with the bottom in working, the mouth of the pipe being bent downward so as to penetrate the material, instead of working against a breast, the vessel steaming ahead all the time. This gives comparatively little chance for large inrushes of water to the pipe, as long as the steamer is working in smooth water. The material consisted of well-compacted gravel, coarse gray sand and shells to a depth of 2 ft., underlaid by coarse sand. Much of the material was so nearly of the same specific gravity as the water that when it became agitated and minutely incorporated with the water by the action of the pumps and the currents in the suction pipes and hoppers, it settled so slowly in the hoppers that a portion of it went overboard with the overflow and was carried beyond the limits of the channel by the transverse surface currents, to the benefit of the government and the corresponding disadvantage of the contractors, who removed about 1.73 cu. yds. of material for each cubic yard for which they were paid. The amount dredged (and paid for) was about 5,000,000 cu. yds., which had to be carried out to sea, the average round trip being 21 miles. The material had to be raised from a depth of 24 to 35 ft. under water and elevated to a height on shipboard which amounted to 36 or 46 ft., according to the state of the tide and the depth of the channel. For each cubic yard of solid material thus handled, there had to be raised many cubic yards of water to a height of 10 to 15 ft. from the surface of the water to the mouth of the discharge pipe. The contract prices averaged 24.48 cts. per cu. yd., but since the government has acquired the plant the cost is only about 11.9 cts. per cu. yd. Where the suction pump is used in this system there is the disadvantage of carrying a large proportion of water in the hoppers, which proportion is, of course, very much less where dredge buckets are used.

The fourth system of handling includes various styles of mechanical carriers or conveyors. One of several methods employed at the Potomac Flats improvement, at Washington, D. C., was a conveyor, consisting of a line of little cars or buckets forming the links of an endless traveling chain, supported on a frame built on barges or floats. This conveyor was fed from the hopper of a ladder dredge, the dredge buckets discharging about 12 ft. above the water level. A somewhat similar plan was employed in the dredging of Lake Fucino, Italy. At the harbor of Otago, New Zealand, the dredge discharged the material onto an endless train of boards, the distance being 130 ft. and the train traveling at the rate of 45 to 50 ft. per minute, being driven by the engines of the dredge or by a separate engine of 8 HP. The Price machine, used on the Manchester Ship Canal, consisted of a ladder dredge discharging the material upon a conveyor 4 ft. wide and about 160 ft. long, composed of elm boards attached to two link traveling chains. The conveyor was at right angles to the dredge ladder, being carried by two barges, and had a hinged jib extending up the canal bank, from which the material fell into railway cars (Eng. News, Sept. 5, 1891). The dredge worked in thick black mud, sand and clay. A modification of this, recently used in excavating for large trunk sewers at Chicago, consisted of a fixed floor or platform, along which the dredged material was carried by scrapers attached to two traveling chains.

Endless belt carriers have been applied to dredges for irrigation canal work, one such arrangement having been shown in our issue of May 16, 1891, where the buckets of a ladder dredge discharge onto one or other of two traveling belts, extending beyond the banks of the canal. For filling in trestles on the New Orleans & Northeastern Ry. (Eng. News, Aug. 4, 1892) a carrier, 90 ft. long, was used, consisting of a five-ply rubber belt, 40 ins. wide, the belt being supported by rollers on an I-beam frame. The dredge was of the ladder type and worked in the soft earth, tough grass and sunken logs of a cypress swamp. A modification of this on the Chicago Drainage Canal had a 22-in. belt extending beyond the cut and discharging onto another 22-in. belt carried by a bridge or truss of 210 ft. span. The bridge moved laterally on tracks and the point of discharge of the belt varied, so as to form a bank as wide as the span of the truss (Eng. News, Sept. 20, 1894). On the Suez Canal, where the banks were too high for long chute conveyors, an elevating apparatus was used resembling the Brown conveyor used on the Chicago Drainage Canal (Eng. News, Oct. 5, 1893). An inclined frame, composed of two parallel lattice girders, was carried by a car running on a track parallel with the canal, and on the top chord ran a truck fitted with traveling and hoisting gear. The ladder dredge discharged the material into boxes or bins on a scow, and when all were filled the scow was towed to the discharging device, and the boxes raised one by one by the truck, and carried up to the shore end, where they were dumped by a tipping apparatus. The cantilever had its lower end 10 ft. and its upper end 45 ft. above the water. Another method employed on the Chicago Drainage Canal consist of a traveling inclined plane, with its tracks at right angles to the cut, the plane being moved along on a track parallel with the cut, and kept opposite the dredge. The dipper of the dredge loads ordinary end dump cars, and a winding engine on the traveler hauls the car up the incline to a dumping frame at its upper end.

The fifth system includes the use of inclined chutes and pipes, down which the material from the dredge is carried by gravity, usually assisted by a stream of water, and care must be taken to prevent the material from depositing in and clogging the conveyor. At the Potomac Flats improvement at Washington, D. C., a clamshell dredge discharged into an inclined chute carried by a scow. On the Appomattox and Wicomico river improvement, executed under the direction of the United States Engineer Corps, a method was adopted by which dipper dredges dumped the material into hoppers at the upper end of chutes 50 ft. and 175 ft. long, respectively, a stream of water being pumped into the chute in each case. A similar method, but with a ladder dredge, was employed on the Kankakee drainage work, the buckets discharging into a chute inclined 30 degrees. The Riker pump, described by Col. Hains in his paper on "The Reclamation of the Potomac Flats at Washington, D. C." (Transactions Am. Soc. C. E., January, 1894) consisted of a steel cylinder 7 ft. diameter and 30 ft. long, with 36-in. horizontal intake and discharge pipes fitted with flap valves opening inward and outward, respectively. This cylinder was set in a hole nearly 30 ft. deep, into which the dredged material was dumped, while the discharge pipe extended up to the high end of a chute, 28 ft. above water level. Steam was let into the cylinder and then condensed by an external shower of cold water, creating a partial vacuum, the external atmospheric pressure then driving the dredged material through the inlet pipe to the cylinder. The inlet valve was then closed, and steam at 40 lbs. pressure was admitted to the cylinder, driving the contents up the discharge pipe to the chute. The steam was then shut off and another vacuum created, the pulsations taking place at intervals of about a minute. The chute was a frame trough about 456 ft. long, supported on trestle bents and having a grade of about 4 per cent. Large quantities of water had to be pumped to spread the material on the dump at the point of discharge. About 400,000 cu. yds. were put ashore by this machine, at a cost, including dredging, of 13 cts. per cu. yd., measured in place, but Col. Hains thought that better results would have been obtained

with an iron shore-discharge pipe instead of the chute. A stone weiging 1,300 lbs., and an iron safe 25 × 14 × 16 ins. were handled. A machine of similar type was built for dredging gold-bearing gravel for placer mining in South America, and worked satisfactorily, except for the occasional clogging of the heavy iron flap valves. When this occurred the machine became inoperative, and the contents of the pump cylinder had to be shoveled out by hand, causing long and expensive delays. The Badger dredge, tried at Coney Island some years ago, had a modified pulsometer pump slung from the dredge boat, having a digger attached to the mouth of the suction pipe, and the material was discharged into a wooden chute. A proportion of 50 to 80 per cent. of solid material was said to be carried (Eng. News, Jan. 30, 1886).

Several French ladder dredges and the Slaven ladder dredges used on the Panama Canal and on the preliminary work for the Nicaragua Canal, as well as some of the dredges on the Suez Canal, had the buckets discharging the material into an elevated hopper, from which extended a shore-discharge pipe, sloping downwards from the dredge, and supported by guys from an A-frame on the side of the dredge boat. These pipes were sometimes as much as 200 ft. long, and water was pumped into the hoppers to wash the stuff through the pipes. If the material is soft and is deposited near the edge of the cut or on low land liable to overflow, bulkheads should be built to prevent the material from getting back into the dredged channel, as it is said to have done very extensively on the Panama Canal work. One style of hydraulic dredge also used on this canal had bottle-shaped hoppers, from which the material was forced through a 20-in. shore discharge pipe by three powerful streams of water converging at the entrance of the pipe. On the Suez Canal, ladder dredges delivered the sand into a semi-elliptical chute 5 ft. wide and 2½ ft. deep, about 230 ft. long, on the top chord of a cantilever truss carried by a separate barge. In this chute was sometimes placed an endless traveling band with scrapers to force the sand along. It was found that fine sand, with an equal amount of water, would flow down a slope of 5 to 10 per cent., but on flatter slopes than this it would settle and form a hard cake on the bottom of the chute, no matter how much water might be used.

The sixth system of handling dredged material which we have to consider is that of pumping the material through pipes for long distances to the point of delivery,. One of the earliest applications of this system was in the construction of the ship canal at Amsterdam, Holland, about 1867, where a ladder dredge discharged the material into a hopper above a horizontal 42-in. centrifugal pump running at 230 revolutions per minute. This pump drew in water on the lower side and mud on the upper side, and discharged the mixture through a 15-in. shore pipe, about 1,500 ft. long, made up of lengths of wooden pipe connected by leather joints and floated on buoys. The point of discharge was 8 ft. above the water level. A dredge and pump working together could discharge 1,500 cu. yds. per day of twelve hours. Some of the French ladder dredges on the Panama Canal had the hopper connected to a centrifugal pump, which drew in the dredged material and discharged it through a 14-in. pipe 600 ft. long, the point of discharge being 30 ft. above the pump or 45 ft. above the water level. The pipe was supported on pontoons, and had flexible leather joints between these pontoons. Stationary plants of this kind, erected on the shore, have been used in Holland for pumping dredged material from the dredge scows to the point of delivery. In the Hussey dredge, which is described and illustrated in another column, practically the same principle is followed as in the Riker dredge pump already noted, but the flap valves are replaced by vertical disk or gate valves operated by steam. These valves are not liable to be clogged, and if a stone or other obstruction should lodge in the seat of the valve it can be blown back by admitting steam to the cylinder or crushed by working the valve rapidly up and down, the valve and seat and working parts being designed with a view to this contingency. The vacuum is created by an interior spray, instead of an exterior shower, and in place of the inclined chute is substituted a shore-discharge pipe supported on pontoons and trestle bents. These modifications increase the practicability of the pump to an important degree. The dredging is performed by sectional buckets, as there is less water handled by this method than suction pumps, and only enough water is added to the material in the hopper to make it flow freely and completely fill the discharge pipe, so as to prevent loss of pressure. The Hussey dredge now in use at Far Rockaway, N. Y., is entirely self-contained, the dredging apparatus, hoppers and pump being all mounted on one hull, the only connection required being that with the 18-in. shore discharge pipe, which pipe is, in this case, about 2,500 ft. long. It delivers about 500 cu. yds. of material per hour. The machine is said to pump mud with 80 per cent. of solid matter to 20 per cent. of water, and sand with 30 to 50 per cent. of solid matter, and it can handle large stones, or, in fact, anything that can pass through the discharge pipe.

In the applications of the sixth system of handling dredged material which have thus far been mentioned, the pumping or delivering operations are quite distinct from the dredging operations, but a combination of the operations has been very extensively applied, by which the pump first draws up the material and then forces it through the shore-discharge pipe to the point of delivery, thus avoiding all intermediate handling, but involving the raising and transportation of large quantities of water, as already noted in regard to the use of suction pumps for hopper dredges. The Bowers, Von Schmidt, Bates, Booth and Moore dredges belong to this combination class of dredges. The Bowers dredge, which is one of the most extensively used suction or hydraulic dredges, has a centrifugal pump which draws up the material through a suction pipe fitted with a rotary excavator at its mouth, and discharges it through a floating discharge pipe supported on pontoons. One of these dredges, working at South Bend, Wash., delivered 165,000 cu. yds. of compact sand (measured in the fill) in 20 days, or an average of 8,250 cu. yds. per day. Another, at Portland, Ore., raised 1-in. to 2-in. coarse gravel (with some 5-in. cobblestones) from a depth of 25 to 40 ft., and delivered it at an elevation of about 30 ft. above water through an 18-in. discharge pipe about 1,000 ft. long. The cutter is used in both hard and soft material, so as to keep the pump well supplied with solid material. The development of this dredge was recorded in our issues of Aug. 4 and 11, 1892, and the results of the litigation in favor of Mr. Bowers were noted in our issues of Aug. 23 and Oct. 11, 1894.

The early form of the Von Schmidt dredge had a 6-ft. horizontal cutting wheel revolving in a case or hood, like an inverted dish, the mouth of the 20-in. vertical suction pipe entering this hood, and the shaft of the cutter being carried through brackets attached to the outside of the pipe. The shaft was driven by bevel gear, and a centrifugal pump drew up the material and forced it ashore through the delivery pipe. This machine was shown in an article on "Dredging Operations and Appliances" in our issue of July 16, 1887. The work of the Von Schmidt dredge at the harbor of Oakland, Cal., which work was done under the charge of the U. S. Engineer Corps, has been described in a paper by Mr. L. J. Le Conte (Transactions, Am. Soc. C. E., January, 1884) in which it was stated that with the sticky blue mud there dealt with it was not advisable to carry more than 15% of solid matter in the discharge, the large percentage of water being required in order to get a widespread and uniform distribution of the material. In one month 41,000 cu. yds. were excavated and put ashore in 190 engine-hours, and this amount was forced through 2,850 ft. of 20-in. pipe. The maximum cost was 10 cts. and minimum cost 5 cts. per cu. yd., delivered, while similar work with dredges discharging into scows cost not less than 24 cts. per cu. yd., measured in the scow. The improved Von Schmidt dredge used for filling in the Potomac flats at Washington, D. C. (Eng. News, Jan. 4, 1894), had an 8-ft. hood, 22-in. vertical telescopic suction pipe, 20-in. discharge pipe and 8-ft. centrifugal pump. One machine, working in soft material, averaged 350 cu. yds. per hour for several days, delivering through 3,000 ft. of pipe to a point 6 to 12 ft. above the water level. From 30 to 40 per cent. of solid matter could be carried, but threw too much work on the pump, and better results were obtained with 10 to 20 per cent., the engines running at 125 to 130 revolutions per minute. Clay would form balls 1 to 5 ins. diameter in passing through the pipes. A certain small proportion of sand or gravel could be handled if mixed with mud or soft clay, but pure sand would cut out the pumps, and packed hard in the pump and discharge pipes. Boulders as large as a man's head were carried through. The material was discharged into basins formed by low embankments. Great care was required in the operation of the suction pipe, so that it would not be choked by too great a proportion of solid matter, and to prevent injury from the cutters striking logs and other obstructions. The contract prices were from 12.37 to 15.45 cts. per cu. yd.

The Bates hydraulic dredge used on the Chicago Drainage Canal has a 6-ft. centrifugal pump driven by a 250-HP. engine, the pump drawing the material through a hinged inclined suction pipe 20 ins. diameter and 39 ft. long projecting in front of the dredge, the mouth of the pipe being fitted with a concentric rotary cutter, 5 ft. diameter, which cuts a breast and delivers the material to the mouth of the pipe. The discharge pipe is 18 ins. diameter, and connects with an 18-in. shore discharge pipe, which are made in lengths of about 33 ft., with joints of rubber hose strengthened by iron clamps. The machine excavates about 450 cu. yds. per working hour. The material is a soft, black loam, and the discharge from the dredge contains 5 to 30 per cent. of solid matter, depending upon the material, the average being 15 per cent., and in some cases, where the mud is particularly soft, the discharge is said to be practically a paste. The canal on this section is 202 ft. wide at the bottom, and the material is delivered beyond the levees which form the banks. This machine was described and illustrated in our issue of Sept. 6, 1894. Delivering dredges of a similar character, with centrifugal pumps drawing through suction pipes ahead of the dredge boat have been used on the Mississippi River (Fourth District) and on the St. Johns River, Florida, as described in the new book on "United States Public Works," by Capt. W. M. Black, U. S. Engineer Corps. The Vernandon dredge, used on the Panama Canal and in France, was similar to the above in general design, having cutters revolving around the mouth of the suction pipe or in vertical planes at each side of the mouth. The centrifugal pump sent the material ashore through 1,600 ft. of pipe.

The Booth dredge differs from those previously mentioned in having a reciprocating instead of a rotary or centrifugal pump, its special peculiarity being that flexible diaphragms are introduced between the pump chamber and the dredged material, so that the latter never comes in contact with the plungers (Eng. News, March 26, 1892), but has a straight passage, obstructed only by two flap valves. Large stones can thus be passed without injury to the pump. The material is drawn up through an inclined 16-in. suction pipe 45 to 60 ft. long, whose mouth rests on the bottom of the stream and is suspended from an A-frame or derrick boom in front of the dredge boat. A cutter and stirrer are provided for working in clay and other hard material. The discharge pipe was 14 ins. diameter. This machine was specially designed for filling in tracks of land lying below high water level on the Mississippi River, and it is said that for sand it can be worked to a depth of 50 ft. Three of these machines working in sand (weighing about 1 ton per cu. yd.), mixed with gravel, rock and sawmill refuse, had to discharge over an embankment 28 ft. high, and through 2,000 ft. of delivery pipe. In this particular case the pressure averaged 40 lbs. per sq. in. on the discharge, and 15 ins. of vacuum on the suction, while the proportion of solid matter ranged from 5 to 15 per cent., the amount delivered being about 1,000 cu. yds. per day of 11 hours. The Moore dredge used in the improvement of the Delaware River at Philadelphia, Pa., is a direct-acting dredge pump of the vacuum-pump or pulsometer type (like the Badger, Riker and Hussey dredge pumps), having an upright cylinder 7 ft. diameter and 30 ft. high, with 33-in. intake and discharge pipes, the latter increased to 36-in. at 120 ft. from the pump. The vacuum seldom exceeds 10 ins. (though a 30-in. vacuum can be formed when handling some material), and the discharge is through 1,120 ft. of pipe, the lift from the pump being 43 ft. Logs 6 ft. long and 12 ins. diameter, and stones weighing 700 lbs. have been passed.

The material is delivered with 50 to 80 per cent. of solid matter.

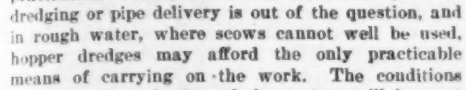
The comparative merits of the different systems mentioned is not a subject for discussion on a wide basis, for it must be remembered that in many cases only one system of dredging or handling is practicable. Thus, for small contracts hydraulic dredging or pipe delivery is out of the question, and in rough water, where scows cannot well be used, hopper dredges may afford the only practicable means of carrying on the work. The conditions governing the selection of the system will in most cases be the character and extent of the work, the material to be dealt with, the time available, and the cost of plant and operation. As to the cost of dredging and delivering by different systems, no figures definite enough to be of any real value can be given, for three principal reasons: In the first place, prices are usually given for the material delivered, and no attempt is made to separate the items involved in dredging and delivering; in the second place, prices for similar classes of work vary greatly, according to local conditions, such as competition, prices of coal and labor, obstructions to work, hire of tugs for scows, the importance of the contract, etc.; and, in the third place, most of the prices on record are those bid under contract, and include a varying and indefinite margin for profit and contingencies, thus precluding any comparison of the cost on different works. Thus the work done in New York Bay by suction pumps and hopper dredges averaged 24.8 cts. per cu. yd. when done by contract, but only 11.9 cts. by the same plant when acquired and operated by the government engineers. The cheapest method of handling for large quantites of material is probably by pumping through pipes, the cost of such work being given in some cases as low as 3 to 7 cts. per cu. yd., under favorable conditions. This is inclusive of dredging, and represents the cost of the material delivered, but it is hardly to be expected that contract work will be undertaken at any such prices.

LETTERS TO THE EDITOR.

ROAD REPAIRING IN NORTH CAROLINA.

Sir: As is well known to many of your readers, some of the Southern states are inflicted with a "road law," the purport of which is about as follows: Overseers are appointed who have charge of the highways in a certain district of the country. These overseers are not supplied with money, men or tools, but are supposed (the courts of Virginia have recently said nay!) to have authority to demand of every able-bodied man in their district a day's work, or in lieu thereof "a substitute or a dollar."

While on a recent visit to North Carolina, I witnessed a good illustration of the practical working of this law. It had been raining for days, and the soft clay roads, from which the sandy top soil had been washed and worn away, had assumed a section like this:



The "road force," consisting of a negro, a mule and light plow, and 16 to 18 citizens, armed with light tobacco hoes, were hard at work on their crusade of reform. The negro and the mule plowed back and forth in the furrow, A, and the laborers, with their hoes, drew the earth and mud on top of the hillock, B, and filled the ruts with the points, C. Where an unusually bad mud-hole occurred they covered it with fine brush and then neatly covered the brush with earth and left the treacherous surface as a trap for the first unfortunate quadruped that passed to fall into. The question of drainage was left to a Special Providence and the hot sun, and when the road was finished the section had changed to this:

The bottom of the side ditches was not below, but above the lowest part of the road bed some 6 to 18 ins.

After watching the proceedings for some time, I inquired of the "nigger and mule": "Do you think you will get a good road?"

The mule stopped, glad of the opportunity; the negro's face broke into a broad grin, as he quickly replied: "I spec' not, boss, 'speshly if dey 'pend on dis dratted mule."

R. Taylor Gleaves.

Lynchburg, Va., June 7, 1895.

SEWAGE PURIFICATION IN AMERICA.

(Continued from page 335.)

Minor Plants in the Menominee River Valley, near Milwaukee, Wis.

A general cleaning-up of the Menominee River valley, adjacent to the city of Milwaukee, has been attempted in the last few years. This has followed the construction of intercepting sewers and other improvements within the city limits designed to remedy grave nuisances caused by the pollution of the river. When the city had done its part it was found that the sewage of some 12,000 people, according to Dr. U. O. B. Wingate, Secretary of the Wisconsin Board of Health, was still discharging into the river outside the city limits. In addition, offensive manufacturing wastes contributed to the pollution.

In 1893 the Wisconsin legislature instructed the State Board of Health to prepare plans and estimates for a sewerage system to serve this district. It also enacted further legislation, requiring all sewage to be filtered or otherwise purified to the satisfaction of the above board before being discharged into the river. Through lack of appropriations the State Board of Health has been unable to prepare the plans mentioned above, but by July, 1894, all but one of the manufacturing establishments and public institutions had initiated some method of treating their sewage. We are indebted to Dr. Wingate for a general outline of the work thus far done, and to the persons mentioned below for further information regarding some of the plants.

A curled hair works, Dr. Wingate states, screens out some of the solid matter from its liquid wastes, and discharges the water onto porous soil, where it disappears. The same system is in operation at a sanitarium having from 30 to 40 inmates. Mr. A. L. Schnidt is proprietor of the hair works, and Dr. J. H. McBride of the sanitarium, the address of each probably being Milwaukee. The Gettelman Brewing Co. had done nothing up to Jan. 21, 1895.

The National Soldiers' Home, having over 2,000 inmates, and discharging some 270,000 gallons daily into the river, decided to comply with the law by constructing an intermittent filtration system, with Mr. W. S. MacHarg, of Chicago, as designing engineer. The probable success of this system is commented on below. Col. Cornelius Wheeler, National Home, Wis., is Governor of this institution.

At the shops of the Chicago, Milwaukee & St. Paul Railway Co., at Merrill Park Station, the excrement is cremated by means of a plant built by the Fuller & Warren Warming & Ventilating Co., 147 Lake St., Chicago.

Combined chemical precipitation and filtration are employed at the public institutions of Milwaukee County and by the Miller Brewing Co. These two plants were described by Dr. Wingate in a letter addressed to this journal July 2, 1894, as follows:

> The county institutions, consisting of a hospital, almshouse, two insane asylums, etc., having over 1,000 inmates, have connected all of their institutions to one sewer and put in a plant, which is working very satisfactorily, the system being the precipitation and filtration system. They are precipitating with lime and sulphate of alumina, and the effluent is clear and free from odor, and thus far has not undergone secondary decomposition, but they have a chemist watch it carefully all the time. The sewage from these institutions amounts to from 250,000 to 400,000 gallons per day.
>
> The F. Miller Brewing Co., which produces several thousand gallons of sewage per hour, has a similar plant, in which they precipitate with lime and ferrous sulphate and filter through limestone, Florida moss, and iron manganese; the effluent in this plant is not very satisfactory and undergoes secondary decomposition. The management will undoubtedly make improvements upon it which may be satisfactory for temporary relief.

The plant for the county institutions was built in 1894 by W. F. Goodhue & H. Schlenstedt, of Milwaukee, joint proprietors of the system used. The brewery plant was put in operation in August, 1893, by Mr. O. E. Meyer, of Milwaukee. Regarding this plant Mr. Meyer wrote as follows on Jan. 24, 1895:

> The plant is not at present doing the work as thoroughly as we would like to have it, owing to its being crowded beyond its capacity and the fact that it is not cleaned as often as it should be. The capacity of the plant is 20,000 gallons of sewage per hour, the amount requiring treatment at the time of its construction in 1893. Since then the flow has been nearly doubled, and of late there has been great negligence about removing the sludge. Owing to the fact that the plant was to be but a temporary affair, it was thought to do away with one of the settling tanks, the sludge pump and the filter press. It is the intention of the company to complete and enlarge the plant in the spring, supplying those parts that have been omitted and that are so essential to the perfect working of the system.

Mr. Meyer states that in his system the sewage is first screened, then receives one chemical and goes to precipitating tanks, where the coarse matters are detained. From here the liquid passes on, receiving a second chemical, and goes to "finishing," or final settling, tanks, from which it passes through two sets of filters. The sludge is pressed.

We may sum up what has been accomplished in the Menominee Valley from a practical point of view by quoting further from Dr. Wingate's letter of Jan. 21, 1895, as follows:

> Two of the plants which have been built are satisfactory in their construction, but their management is unsatisfactory, and but very little improvement in the river has resulted, as yet. In our report to the legislature the State Board has given its opinion that no process will be satisfactory for this district except a permanent system of sewerage, and we have recommended a mandatory law that this be provided for forthwith. It seems that the different institutions have an idea that constructing a plant is all that is necessary, and they will not, or do not, furnish the necessary agents and help to keep the plant in proper condition, or manage it in the proper manner. The National Soldiers' Home have arranged for an expensive interm'ttent filtration system, but the soil is such that the Board has grave doubts about this being a success for any length of time.

AMERICAN AND FRENCH FOUR-CYLINDER COMPOUND FREIGHT LOCOMOTIVES.

The four-cylinder system for compound locomotives is regarded with considerable favor on the continent of Europe, more especially in France and Austria, in which latter countries it is largely used, both for fast passenger and heavy freight engines, and some of the engines have been described and illustrated in our columns. In some cases tandem cylinders are used, but in France it is usually preferred to have all the cylinders independent, with the high-pressure cylinders driving one axle and the low-pressure cylinders driving another, thus balancing the working parts, and to some extent avoiding the severe strains to engine and track, caused by bad counterbalancing. The four-cylinder compound system has been very extensively used in this country, generally on the Vauclain plan, with all cylinders outside and the high and low-pressure cylinders on each side placed one above the other and connected to one cross-head. In this way the balancing effect due to the use of four cranks is not obtained. In our issue of Feb. 7 we discussed the question of multi-cylinder locomotives and their relation to counterbalancing, and also published full particulars of some three-cylinder simple engines in use in this country, which were designed for the purpose of obtaining a more uniform turning moment than is obtainable with two cranks. In the present article we describe a heavy French freight engine, with four cylinders and eight driving wheels, illustrated in the "Revue Generale des Chemins de Fer," and in comparison with it we give (in our standard form) particulars of an American four-cylinder consolidation freight engine, with approximately equal weights on the driving wheels. This latter engine is one of seven built for the Philadelphia, Reading & New England R. R. by the Baldwin Locomotive Works, and we are indebted to the builders for the list of dimensions.

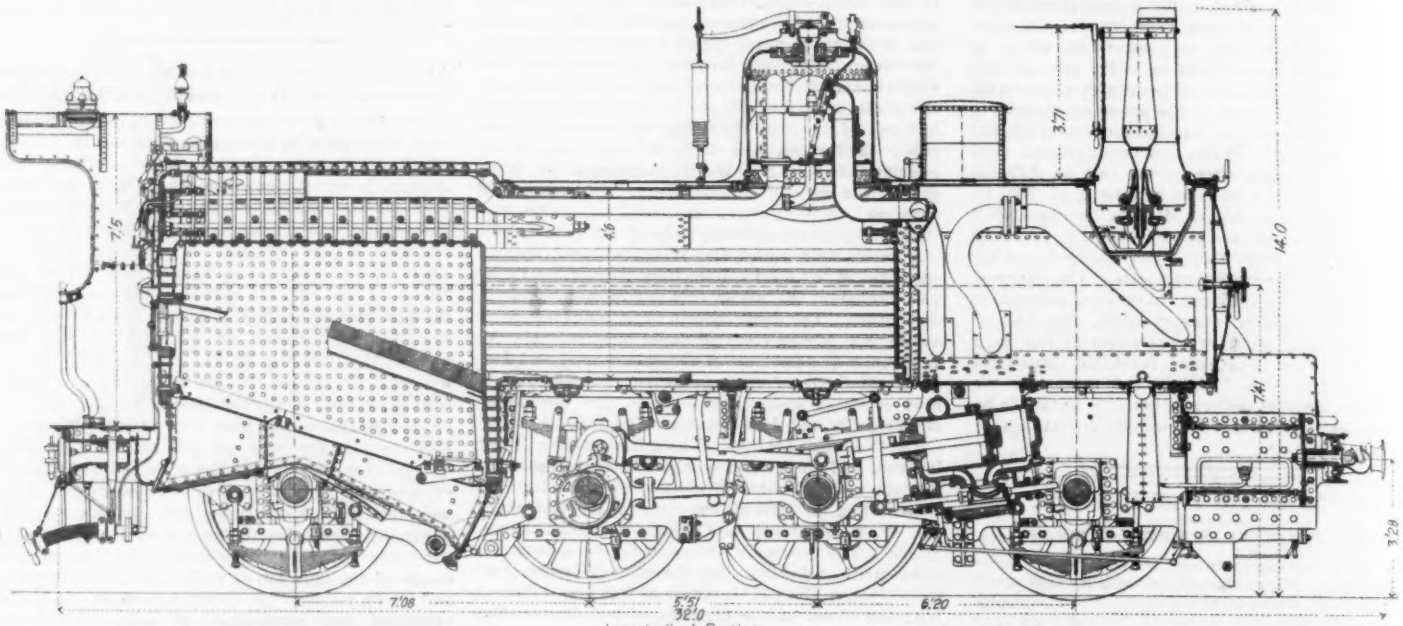
The French engine is one of a class of freight engines introduced in 1893 by the Paris, Lyons & Mediterranean Ry. for hauling through freight trains on the main line between Paris and Marseilles, about 536 miles, which line has easy grades and a very heavy traffic. They are also used for passenger and mixed trains on some lines with heavy grades. The whole weight of the engine is carried on the eight driving wheels, all of which have flanged tires. The high-pressure cylinders are inclined 7° 48', placed inside the plate frames, between the front and second axles, and drive a crank axle carrying the third pair of wheels. The low-pressure cylinders are horizontal, placed outside, at the extreme front end of the frames, and drive the second axle. All the wheels are connected by coupling rods. The high-pressure valve chests are below and the low-pressure valve chests above their respective cylinders. The cranks of the two axles are set at 225°. The valves are of the double-port or Allan type, and the four valve gears are of the Walschaerts system, controlled by a single steam reversing gear, which effects a proper relation between them for any rate of expansion, independent of the will of the engineman. A special valve enables the engineman to admit live steam to the receiver, but at starting only, and without the steam

going from the high-pressure cylinders to exhaust into the atmosphere, a safety valve on the receiver limiting the pressure therein. The boiler has Serve ribbed tubes, a copper firebox, and an extension smokebox, but in the latter the smokestack is placed at the front end instead of at the back, as in American practice. The smokestack is of the straight pipe pattern, with the exhaust pipes led through the sides of the smokebox to nozzles near the base of the stack, a bucket-shaped spark-deflector enclosing the nozzles and base of stack. The receivers are large copper pipes within the back part of the smokebox. A cinder discharge pipe is fitted at the bottom of the smokebox. The stack has a raised shield in front of the top to give the steam and smoke a more free escape when running, and there is also a horizontal damper to close the top when desired. The boiler is set low in the frames. A noticeable feature is the shortness of the boiler

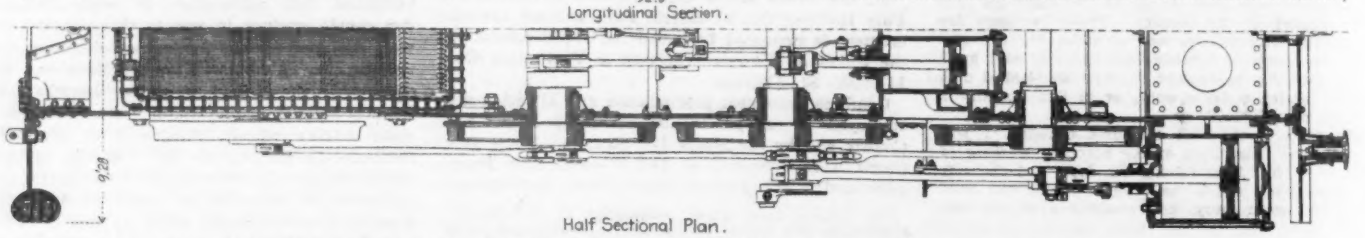
Western New York & Pennsylvania R. R. showed, as the result of two years' service, a fuel economy of 15% over a simple engine running in the same service, as described in our issue of Oct. 4, 1894. The following table gives the comparative dimensions of the American and French engines:

Dimensions of American and French Four-Cylinder Compound Freight Locomotives.

	American. P.R.&N.E.R.R.	French. P.L.&M.Ry.
No of driving wheels	8	8
No. truck wheels	2	0
System of compounding	Four-cylndr.	Four-cylndr.
No. of cylinders, h.p.	2	2
" " " l. p.	2	2
" " axles driven	1	2
Running Gear—		
Driving wheels, diam.	4 ft. 3 ins.	4.92 ft.
Truck wheels, diam.	2 " 6 "	....
Tender wheels, diam.	2 " 9 "	....
Eng. truck, length radius bar	5 " 8½"	....
Engine truck	Swing bistr.	....
Journals, driving axles	7 × 8½ ins.	7.6×9.75 ins.
" truck axles	5 × 8 "	....
" tender axles	3¾ × 7 "	....
Firebox.—Length inside	8ft.7 3-16ins.	top, 7.38 ft. bott. 7.63 "
Width inside	2 " 9⅝ "	top, 3.51 " bott. 3.34 "
Depth at front	6 " 1 "	5.79 "
Depth at back	5 " 10 "	3.71 "
Thick. side and back plates	5-16 in.	0.6 in.
" crown sheet	⅝ "	0.6 "
" tube sheet	½ "	1 in. at tubes 0.68 in. below
Grate area	24 sq. ft.	26.47 sq. ft.
Stayboits, diam.	1 in.	.....
" pitch	4 ins.	3.3 ins.
Water space, width	3 "	.....
Tubes.—Material	Iron.	Steel.
Type	Plain.	Serve.
Number	239	139
Diameter, outside	2¼ ins.	2½ ins.
Pitch	2⅞ ins.	.....
Thickness	12 W. G.	.....
Length bet. tube plates	13ft.2¼ ins.	9.84 ft.
Heating surface:		
Ratio to grate area	84.2 to 1	62.71 to 1
Tube ar. to firbx. ht. surf.	11.3 to 1	14.74 to 1
	Exterior.	Interior.
Tubes	1,856.5 sq.ft.	1,554.3sq ft.
Firebox	164.5 " "	105.34 " "
Total with ext. tube area	2,021.0 " "	.....
Total with int. tube area	....	1,659.73 " "



Longitudinal Section.



Half Sectional Plan.

FOUR-CYLINDER COMPOUND FREIGHT LOCOMOTIVE; PARIS, LYONS & MEDITERRANEAN RAILWAY.

barrel and the tubes, but this has been already adopted in express engines of similar type as the result of experiments which showed that 2½-in. Serve tubes, with eight ribs, gave the maximum evaporation with a length of 9.84 ft., as noted in our issue of July 26, 1894.

A large dome is placed at the extreme front end of the boiler barrel, taking steam from a horizontal pipe led from the steam space over the firebox. The safety valve is of the spring balance type. The sandbox is placed on the smokebox, and has pipes to the front and back of the second pair of driving wheels. All the wheels are flanged, and a noticeable feature is that the springs are equalized throughout. The springs of the two middle wheels are above the axles and those of the end wheels are below the axles. The ashpan is cambered to make room for the rear axle, and has doors at front and back. The firebox has the grate inclined 17°, with a dumping section at the lower end, and there is a deflector plate over the top of the fire hole, and a firebrick arch over the lower part of the grate. The cab is very narrow. In fuel consumption the compound engines are said to show an economy of 12 to 14% over the simple engines.

The American engine is of the ordinary consolidation type, and an engine of the same type on the

Wheel Base.—Driving	14 ft. 0 ins.	18.79 ft.
Total engine	21 " 10 "	18.79 "
" tender	15 " 1 in.	....
" engine and tender	47 " 9½"	....
Truck pin to c. of lead. driver	7 " 10 "	....
Driv. wheels hav'g blind tires	2d & 3d.	None.
Weight in working order:		
On drivers	118,020 lbs.	118,140 lbs.
On truck wheels	13,200 "	....
Engine, total	131,220 "	118,140 lbs.
Tender, total	about 73,000 "	....
Engine and tender	" 204,220 "	....
Tender empty	" 29,350 "	....
Of full coal capacity	" 17,000 "	....
Full water cap. of tank	26,650 "	....
Cylinders, h. p. (2)	13½ × 24ins.	14.4 × 26 ins.
" l. p. (2)	23 × 24 "	23.6 × 26 "
Ratio of area of h. p. to l. p.	1 to 2.9	1 to 2.6
Distance c. to c., outside cyls	7 ft. 2½ ins.	6.88 ft.
" c. of h.p. to c. of l.p.cyls	1 " 8 "	....
" c.—c.of h.p. insd.cyls	....	1.64 ft.
Piston rod, diam.	3¼ ins.	2¼ & 2⅝ ins.
Guides	4-bar.	2-bar(outs.)
Connecting rod, c. to c.	9 ft. 3¾ ins.	5.33 ft. (ins.)
Valve Gear.—Types	Stephenson.	Walschaerts.
Valves	Piston.	Slide.
Ports: steam	1½×21¾ ins.	....
" exhaust	4½×21¾ "	....
Slide valves:		
Lap, outside....h. p., ⅞-in.; l. p., ⅝-in.		....
Lead.....h. p., 1/16-in.; l. p., ⅝-in.		....
Max. travel	5 ins.	5.7 ins.
Boiler.—Type	Wagon top.	Rad. fireb'x
Length of barrel	....	9.5 ft.
Diam. of barrel inside	4 ft.10¾ ins.	4.6 "
Thickness of barrel plates	⅝ in.	0.6 in.
Thick. of smokebox tube plate	½ "	0.8 "
Height rail to center line	7 ft. 8 ins.	7.41 ft.
Length of smokebox	5 " 10¾ "	7.62 "
Working pressure	180 lbs.	200 lbs.

Miscellaneous:		
Exhaust nozzle, diam.	3½, 3¾ or 4 ins.	
Smokestack, smallest diam.	18 ins.	21.6 ins.
Smokest'k, height,rail to top	14 ft. 6 ins.	14.0 ft.
Capacity of tank	3,200 galls.	....
Capacity of coal space	about 17,000 lbs.	....
Brake fittings	Am. equalized, air	....

In regard to the use of four independent cylinders, and its effect upon the steady motion of the engine, it may be noted that the Gothard Railway has some four-cylinder compound express engines of the ten-wheel type, but having the arrangement of the cylinders somewhat different from that of the French freight engine illustrated. In the Swiss engine, the high-pressure cylinders are inside the frames, between the truck axles, and drive the front driving axle; while the low-pressure cylinders are outside, placed behind the truck wheels and driving the middle driving axle. Reference may also be made to the four-cylinder balanced engine, mentioned by Mr. Strong in his discussion of the subject of the counterbalancing of locomotives (Eng. News, Jan. 17, 1895).

More complete utilization of the power of St. Anthony's Falls and the rapids below, at Minneapolis, Minn., is proposed by Engineer E. Nelson. He proposes a great canal from the Falls to Fort Snelling, creating a fall of 105, instead of the 45 ft. now used, and capable of developing 90,783 HP., or a gain of 51,120 HP. on the present falls. No estimate of cost is given.

RECENT PROGRESS IN CAR HEATING.

At the May meeting of the Western R. R. Club a brief paper on "Car Heating" was read by Mr. J. C. McMynn, of Robert W. Hunt & Co., which we abstract as follows:

There seems at the present time to be a revival of interest in the matter of heating cars from the locomotive. The subject divides itself into four heads. (1) Possibility of heating by steam. (2) Automatic regulation. (3) Economy. (4) Ventilation. The general public would place ventilation first and economy last. The possibilities of heating by steam have been fully proved, and this system is being more generally adopted as terminal points are becoming more completely equipped with means of heating individual idle cars. Some very ingenious methods of thermal storage are now proposed by the Baker Co. and others. The terrible results of fire from stoves are enough to secure the earnest co-operation of every railroad towards lessening this danger. The widely adopted method of hot water heating has its dangers from scalding in case of accident, and its difficulties from liability of freezing up when cars are not in use for any considerable period.

Automatic regulation on cars has not met with the success that it has in large buildings and residences, yet it has succeeded on cars in several instances. The necessary requisite is a thermostat which is not affected by the jarring of the car. It does seem as though some effort should be made to make it unnecessary for a railway company to warm all out doors if its brakemen should happen to be lazy, as they frequently are.

Very little can be said on the subject of economy, for there is none. A volume could be written on the lack of this attribute. Live steam is taken from the locomotive, and as soon as it has given up a part of its heat it is thrown away.

With the weather at 10° above zero about 15 lbs. pressure is necessary to circulate steam through a train, and the consumption of steam is about 1 lb. per minute per car, or, say, 2 lbs. of steam per car-mile. This figure refers more directly to elevated roads, but I find upon inquiry that 1 lb. of water per car-minute would about cover the cost. With fuel at $4.50 per ton, the total cost of live steam heating is given at 3¾ cts. per car-hour, which, with a train of eight cars, would amount to 30 cts. per train-hour, or a cost of $4.20 for the trip from Chicago to St. Paul. Three hundred and sixty-five trips per year would amount to $1,533, and eight trains per day, $12,264, an interest on $204,400.

With the old-fashioned car stove about 10 lbs. of hard coal was burned per hour, or with two car stoves in a car 20 lbs. per car-hour. Taking the same case as before, the actual cost of fuel per trip would be $5.04, and extra attendance and repairs nearly as much more, besides only half heating the car, since over 50% of the heat will escape through the stove stack.

Mr. A. M. Waitt (L. S. & M. S.): Some six years ago when I connected myself with the Lake Shore road, I found the steam-heated cars equipped with a system of direct steam heating, in connection with which system there was an automatic trap used. We had constant trouble with the traps in the winter time, on account either of their wasting a great deal of steam, or else on account of their being so adjusted that the water would accumulate and get cold enough to freeze, so that when we would go into a terminal station where the temperature was quite different from that where the car started out at the other end of the road, we would find the traps frozen up; and the car had to be set out at one side, and torches or live steam used to thaw it out. We had a great deal of trouble from that cause; in fact, the traps would frequently freeze up on the road. When we equipped cars later on with a direct system of steam, it suggested itself to me that it might be wise to see what kind of an arrangement could be devised without using traps at all, and so we equipped quite a large number of cars, some hundred or more, and did away with the traps. We have used some of those—at least 50 of them—through three winters, and 100 through two winters, this last winter being a very severe one. This experience, during which we have had, I might say, an entire absence in the coaches of any trouble from freezing—in fact, freedom from any trouble at all with circulation—has demonstrated to me very clearly the wisdom of doing away with the traps on our cars, and as rapidly as the cars come into the shops the traps are being taken off.

The experience that we had on our cars was entirely with one make of trap, but I have watched the devices on the cars of other roads that run over our line, having different styles of traps, and in none of them have I found the trap free from the difficulties caused by either letting out too much live steam or by freezing up. Even with those that are most highly spoken of by the inventors and by those who are selling them, I have found a great deal of difficulty in handling them on the road. As I found no trouble whatever with the absence of traps, I naturally have become a strong advocate of doing away with traps in connection with direct steam heating on cars.

With regard to the regulation: I know that we all find a great deal of trouble in cars that are heated by direct steam, on account of being roasted in mild weather, and once in a while, rarely, finding the cars cold in intensely cold weather; but the latter is the exception. It does seem, from some experience I have had during the last three years, as though it were not absolutely necessary, with direct steam in coaches, to have intensely hot cars in mild weather. Mr. McMynn made mention, I think, of the trainmen being lazy sometimes, or suggested that, as they were lazy, we were attempting to heat all out doors, as well as roast the passengers. I think it is possible, and a very simple thing if undertaken in the right spirit by the officers in charge of the operation of the train, to maintain such discipline among the trainmen as to have them properly regulate the steam heat. Of course, you have got to assist them by giving them proper means for regulation. Now, we have used in our cars, very successfully, a steam admission valve, which is adapted to help the trainmen in bringing about that end. Ordinarily in our cars we used a common globe valve, a valve that, after it had been used a few times, would, from its being so distorted by the unequal expansion, leak enough steam to make the car uncomfortable in mild weather. We have substituted for that valve a specially designed valve, by which an almost infinitesimal admission of steam can be obtained, and without any fine adjustment (Eng. News, Sept. 29, 1892). The valve is also so constructed that, even with that small amount of steam coming in, there is no danger at all of cutting out the seat, because the disk of the valve, when a small amount of steam or large amount of steam is going through, is quite a way off from the seat, and the graduation is obtained by an independent means, although connected and controlled by the steam. By using such a valve a trainman can open the valve by turning it one or two turns, admit steam, and if the weather is cool, allow it to blow through the pipes until it comes out of the drip. Our instructions to our trainmen are: In freezing weather always have steam enough going into your car and out of the drip, so that by touching the drip valve you will find it hot. Don't let it be so hot that when you touch it it will burn your finger and you will have to draw it away quickly; but so that it is moderately hot, and then you know water is passing out of the drip and no live steam. It is a very simple matter to control. Our trainmen have no difficulty; and, last winter, with few exceptions (caused principally by green trainmen who had not been instructed), we found there was very little excessive loss of steam from the drips, and, on the other hand, there was very little excessive heating in the coaches by trainmen even in moderate weather. We found in some of our cars that we did not have sufficient piping to get a 70° temperature during some of the most intensely cold weather. That is a matter that we will remedy. I think it is perfectly feasible, with a little care and attention on the part of those who have charge of equipping the cars, and also more especially those who have charge of operating the train, to get very good results, comfortable cars, economy, and lack of wasted steam, by the plain drip valve, without any trap, and by a properly adjusted steam admission valve.

Mr. Wm. Forsyth (C., B. & Q. Ry.): The subject of steam heating was before us as far back as 1887. At that time the Martin system was in its highest state of prosperity, and it was a question whether continuous heating would be a success or not. In introducing the subject before the club at that time, I predicted that continuous steam heating would soon be as familiar a term and as general in its use as continuous brakes, and I am rather surprised, after this period of eight years, that continuous steam heating has not become more general. But considering the discomforts which are experienced in some steam-heated cars, the matter is not surprising.

After eight or ten years' experiment with continuous steam heating, I should say that it was not yet a success, and in saying so I do not want to throw any discredit on the representatives of the steam heating companies, because I believe that mechanically they have done almost as much as they could, and that they have presented to us something which is perhaps nearly good enough. But, as Mr. Waitt has suggested I think that the worst offenders are the superintendents of our railroad companies, or those who have charge of the conductors or brakemen and those who regulate the steam heat. At the last Master Car Builders' convention, we presented a careful report on car ventilation, and showed up the practice that exists on all first-class roads and in first-class cars, but I do not believe the conditions are any better now, or that the report has done any good.

S. P. Bush (Pa. Ry. Lines): We, on the Southwest system, have tried to some extent the system which has been in operation on the Pennsylvania R. R. proper. That system was originally called the vacuum or return system. With this system two lines of pipe are used, one a supply pipe at one end of the cars, the other a return pipe placed on the other side. These pipes are interchangeable as either supply or return pipes, depending upon the direction in which the cars happen to be running. Connections are made from the center of these pipes with the radiating, or heating, pipes in the interior of the cars. The connection between cars consists of a U-shaped hose placed horizontally so as to avoid a pocket. The supply of steam and exit of condensed steam and water are controlled by suitable valves. A vacuum pump is placed on the tank of the locomotive, and the steam used in operating the vacuum pump when exhausted is passed into the supply pipe, which is sufficient to properly heat trains in the case of moderate temperatures; at lower temperatures, live steam is also admitted to the supply pipe.

The object of this system is to properly heat cars with as low a pressure in the radiating pipes as possible, and at ordinary temperatures very little, if any, pressure is necessary in the radiating pipes. In very cold weather somewhat more pressure is necessary. As in the case of all systems of steam heating, the greatest difficulty we have is in obtaining careful manipulation. One of the difficulties that has been experienced in maintaining the proper temperature in all the cars of a train has been that too much steam is oftentimes admitted to the first two or three cars, more than is necessary to maintain the proper temperature, and in addition to the water of condensation that passes into the return pipe, some steam also passes with it, which destroys the vacuum and prevents a proper circulation in the rear cars.

It has been suggested that cars may be heated properly and at the same time have a vacuum in the radiating pipes. This might be done were it not for the fact that the heating surface which it is possible to apply to cars is necessarily limited, and at low temperatures this limited heating surface will not condense all of the steam that it is necessary to use in order to properly warm the cars. The vacuum system is used in buildings, but the conditions are different, and a sufficient radiating surface can be provided which will condense all of the steam admitted, and conduct the heat to the atmosphere.

One of the advantages which the return system is supposed to furnish over the direct system is that all escape of water and steam under cars is avoided. This escape of water and steam is oftentimes very disagreeable; it freezes on station platforms, and at stations where a large number of trains are handled the drippings are considerable. The steam escaping from the drip valve in the direct system also impedes the vision of trainmen and passengers at stations. I would state that the return system can successfully heat trains of even twelve cars in zero weather, if it is properly manipulated. One of the greatest difficulties, however, that we have experienced, and as stated by the others who have just spoken on the subject, is in obtaining careful manipulation.

Two things that have a very important bearing on the matter of car heating are the arrangement of pipes and ventilation, and it would seem that the ventilating and steam heat problems must be considered together. It is a well-known fact that if the atmosphere of a car or room is ordinarily pure, it is comfortable at a much lower temperature than a car or room having impure atmosphere. It seems most desirable to provide a positive circulation of air in cars, and to compel the fresh air to first pass over the heating surface, thence into the body of the car; and to provide enough fresh air to maintain a comparatively pure atmosphere. The Pennsylvania R. R. is making some experiments in this direction, but it cannot be stated at this time exactly what can be done.

Mr. E. W. Grieves (B. & O. Ry): During the last session of the Maryland legislature a law was passed forcing all railroads running through the state of Maryland to use steam heat, and the B. & O. were compelled by this law, during this last year, to steam-heat all their equipment, and we found that the problems in regard to steam heat were numerous. We have about 100 cars equipped with water circulation with one or two different systems. The remainder of our equipment is direct steam. The Pullman Company issued instructions, at our request, some time since, that the porter should only be responsible for the valve on the inside of the car admitting steam to the car, the trainmen and our car inspectors being responsible for the trap or valve underneath the car, as the case might be; and we found that we had better results from this way of handling the matter. We had quite an experience with traps, and while we are still using them, we find there is some difficulty in regard to them.

Mr. J. W. Marden (Fitchburg Ry.): The matter of steam heating has got past the experimental stage with us, and we hardly need pay any attention to it; it takes care of itself. We use direct steam, known as the Consolidated Car Heating Co.'s system, in which we pass the steam from the engine directly to the rear of the train, and then into each car by a globe valve. We use no traps, but use a globe valve to allow the condensation to pass off. We have no freezing of pipes, and I do not know that we have had a report from our passengers during this past winter as to excess of heating or cold, so we think we are pretty well

fixed. I do not know that we would want to change even for anything better, at present.

Mr. Jacob Johann (Chicago & Alton Ry.): The greatest trouble that I have experienced with steam heat was, as some of the members have remarked, the automatic trap. If the trap was not properly taken care of, of course it would stop up and freeze, and the result would be no circulation, and when there was no circulation of course there would be no heat. It is just the same as if the blood stops in our system. That settles us, and if the automatic trap stops, of course the heating stops. I am decidedly in favor of steam heat. I think it is the proper thing in cars, and, with all conditions properly adjusted mechanically, I think it is the most economical car heating that we can have. I have ridden long distances on trains that were heated with steam heat, and there was no trouble in keeping up a good, pleasant temperature; but it is like everything else, it has to be attended to. If it doesn't get any attention it stops working.

Mr. A. E. Manchester (C., M. & St. P. Ry.): I am of the opinion that steam heating is here to stay. I believe that its range is greater than almost any other system that we can use. On our system we have to prepare our cars to keep them warm in such climates as Northern Michigan and Northern Minnesota, and also to have them equally comfortable for service in Missouri, and we are able to do this with direct steam heat, where the heat is properly handled. We have experienced a great deal of the same difficulty that was stated by Mr. Waitt with the automatic trap. We are now discarding it and depending upon the drip. We find that having the controlling valves for the admission of steam into the car and the escape of the drip, both inside the car where they can be reached and handled at any time, it is more possible to keep the car in good condition so far as warmth is concerned, and to prevent their being frozen up in extremely cold weather. The great problem in steam heat to-day is to educate the men to the handling of the steam heat, instead of finding new devices.

Mr. Jas. F. McElroy, of the Consolidated Car Heating Co., then read a paper describing some experiments which he had made to determine the cause of circulation in closed coil heater systems, such as the Baker heater. He found by experiment that the commonly-accepted opinion that circulation is due to the difference in the specific gravity of the hot water in the rising pipe and the cooler water in the descending pipe is erroneous. The circulation is actually caused by the formation of steam bubbles in the rising pipe, heated by the fire in the heater. The result is the upward movement of the water in accordance with the well-known laws which the air-lift pump has made generally familiar. The conclusions which Mr. McElroy reached as a result of his experiments were as follows:

(1) The theory of water circulation based on different densities of water at different temperatures, does not account for the circulation of water in that class of heating apparatus in which the heater is placed on a higher level than the radiating pipes.

(2) The temperature of the water in the Baker heater coil when circulation is taking place is always up to 212° Fahrenheit when atmospheric pressure is carried on the system.

(3) A circulation of the Baker heater through the radiating pipes in a car never takes place unless steam bubbles are formed in the coil of the heater.

(4) In ordinary cases the action of the Baker heater is periodic, giving an intermittent flow of water through the pipes. In a few cases, and then continuing for a short time, the action is found to be continuous. At such times steam is formed within the coil in bubbles, and passes up a short distance in the riser, but is condensed before reaching the expansion drum.

(5) The greatest action and the freest circulation are obtained with the Baker heater, when such conditions exist as permit the formation of the greatest quantity of steam bubbles within the riser.

(6) The pressure within the Baker heater system acts to prevent the formation of steam bubbles, and hence retards or prevents the circulation of water through the radiating pipes. This pressure causes the radiating pipes to cool down, but raises the temperature of the water within the coil and expansion drum.

(7) Any drum system of heating, when applied to a hot water circulating system, operates under similar conditions exactly as the Baker heater.

(8) Steam bubbles must form within the coil of pipes of any drum system to cause a circulation.

(9) Steam pressure admitted to the drum from the train pipe must be equal to or greater than the pressure carried within the Baker heater system, otherwise it will be impossible to generate steam bubbles within the pipes in the drum.

(10) It is important that expansion drums of sufficient capacity should be used, having space for expansion in upper half of drum equal to about one-tenth of the capacity of the heating apparatus to the middle line of expansion drum.

(11) In applying an expansion drum, the safety valve or other connection into the top of the expansion drum should never be located directly over the riser pipe, because the eruption taking place in the coil sends a column of water and steam into the expansion drum, and strikes with considerable force the top of the expansion drum immediately above riser. This in some cases would make it dangerous, or at least inconvenient, in removing the safety valve for the purpose of allowing the escape of air from the drum.

(12) All heaters should be provided with a pet cock for the purpose of letting off air and steam, so that the expansion drum may be closed without danger to the person operating it.

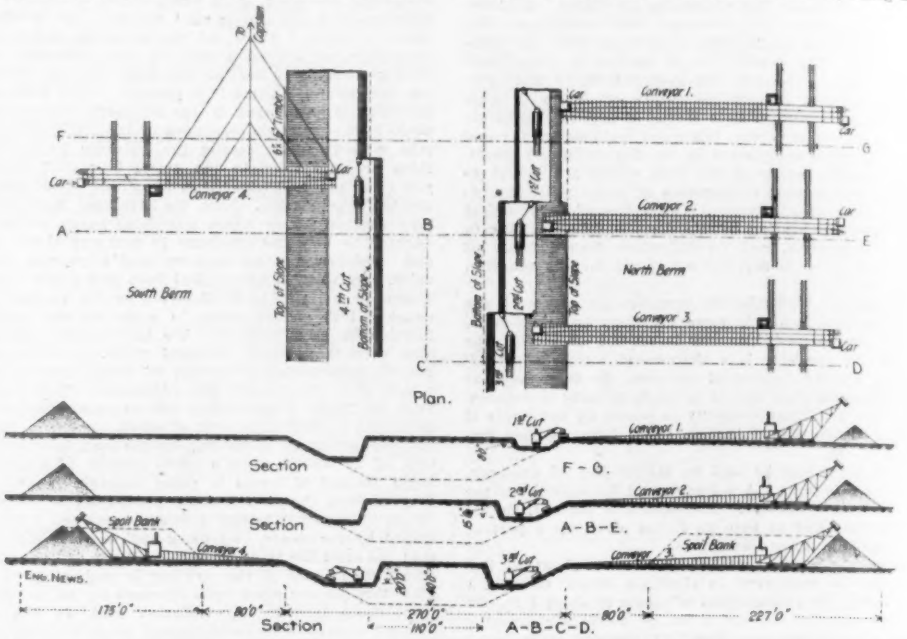


FIG. 9. PLAN AND SECTIONS SHOWING ARRANGEMENT AND OPERATION OF STEAM SHOVELS AND CONVEYORS ON SECTIONS M AND L, CHICAGO MAIN DRAINAGE CHANNEL.

The Heidenreich Co., Chicago, Contractors.

rather hard, compact clay, covered with about 5 or 6 ft. of prairie soil. The channel is 110 ft. wide on the bottom, with 2 ft. horizontal to 1 ft. vertical side slopes. The area for the south spoil bank is 175 ft., and for the north spoil bank 227 ft., with 80 ft. berms between the canal and spoil bank on both sides.

To handle the earth at this low price the contractors resorted to a modification of the inclined plane and tipple often used in the coal regions. The cars running on this incline are loaded by steam shovel and hauled to the top and dumped by a winding engine of ordinary type. Fig. 9 shows the system of incline conveyors used, all the shovels

FIG. 10. VIEW OF INCLINE CONVEYOR WORKING ON NORTH SIDE OF CHANNEL.

THE CHICAGO MAIN DRAINAGE CHANNEL.

IV.

Sections M and L.

The contract for Sections M and L was let to the Heidenreich Co., of Chicago, Ill., Dec. 23, 1893, and called for the excavation of 722,850 cu. yds. of glacial drift on Section M, and 1,101,881 cu. yds. on Section L, or altogether 1,823,731 cu. yds. of material. For Section L the contract price was 19.7 cts. per cu. yd., and for Section M 21.7 cts. per cu. yd., or an equivalent uniform price of 20.4 cts. per cu. yd. for both sections. With the exception of about 40,000 cu. yds. on Section 15, this is the lowest price received for glacial drift on the whole work. The material encountered corresponds very closely to that found on Sections O and N, being a

and conveyors being headed west. Three of the conveyors are placed on the north bank of the canal, and follow each other in the order numbered, each making the cut corresponding to the number of the conveyor. Each of these cuts runs the entire length of the two sections. The gradual deepening and widening of the whole excavation by these successive cuts are clearly shown by the sections. After the third cut is made, the excavation is carried no

deeper until this 20 ft. is taken off the whole width of the channel. On the south bank but one conveyor is used, but as this is operated day and night, while the others are operated days only, and as the south spoil bank is smaller than the other, the excavation of this conveyor is to that of the other three conveyors about as the volume of the south spoil bank is to the volume of the north spoil bank. The top lift of 20 ft. being removed, work is begun at the edge of the slopes of the bottom lift in exactly the same manner as before. In the plan, Conveyor No. 4 shows the attachment of the ropes for moving the approach trestle—i. e., the portion from x to y along the canal bank as the work proceeds. The engines and incline proper are carried on a car which is run by suitable gearing, operated by the engineer.

FIG. 11. GENERAL VIEW LOOKING WEST, SHOWING FULL WIDTH OF CHANNEL, WITH CONVEYORS AT WORK.

Each conveyor consists of a wooden trestle approach, a steel framework incline mounted on trucks and the necessary machinery for hauling the loaded cars. Fig. 10 gives a very good idea of the appearance of the apparatus, except that with this one exception all the inclines are made of steel. Two of the steel inclines are shown by Fig. 11. These two illustrations give a good idea of the character of the work on the two sections under consideration. Fig. 10 shows one of the conveyors on the north side of the canal taking out the third cut. It will be noticed that the slope is finished to the bottom of each cut as the work proceeds. Fig. 11 is an attempt to show the full width of the canal with all of the machines at work, but owing to the great width of the excavation and the slight elevation which could be obtained above the surface, the right side cut is hardly to be distinguished. The inclines indicate where the steam shovels are, however. In the foreground of this view is shown a train of tram cars which were used in connection with wheel scrapers and wagons for taking off part of the top soil. The tram car track is built a few feet west of the east boundary of Section M, and the view is therefore one looking west.

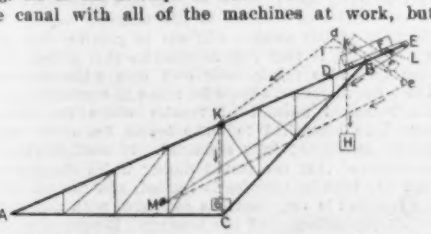


Fig. 12. Diagram Showing Operation of Tipple on Incline Conveyor.

Turning now to the incline, the framework is simple and the machinery consists merely of a 10 × 16-in. double steam cylinder hoisting engine. The only parts of the conveyor which call for any particular description are the tipple and the brake system for controlling the descent of the cars. The tipple is shown in the act of dumping a car in Fig. 10. As will be seen, it is simply a portion of the track at the top of the incline, hung so as to revolve over toward the spoil bank on a horizontal axis. The diagram, Fig. 12, shows the theory of the operation of the tipple. In this diagram A B C is the trussed incline, and D E is the tipple hung on the horizontal axis at B. From the engine the hauling rope passes to the sheave M, thence to the sheave E, and thence to the car F. The car is pulled up the incline track A B, and onto the pivoted platform D E, until the front wheel strikes the buffer, L, which holds the car from going further. There being no further movement of the car possible, the pull on the rope E M tends to revolve the platform D E on the axis B. As the loaded car nearly balances the counterweights holding D E in position, only a slight pull on E M is necessary to revolve the tipple and car into the position d e f shown by the dotted lines. In this inclined position the load slides out of the front end of the car. The pull on E M is then discontinued, and immediately the counterweights G and H act to pull the tipple back to its original position, and the car runs by gravity back down the incline. The counterweight G acts first to start the tipple and bring it into the line of action of the weight H; the weight G then strikes the floor A C, and H acts alone to bring the tipple back into position.

At no time during the operation of hauling and dumping does the engineer see the car, but he regulates all movements by a system of simple automatic signals. As the car approaches the tipple, in running up the incline the wheel flange presses a lever, which rings a bell in the engine room and warns the engineer to decrease speed, and when the tipple begins to swing over, a pointer is operated by suitable connecting wires, which indicates when the position d e has been reached and the load dumped. The engineer then releases his engine drum, and pays no further attention to the car, which is swung back by the counterweights, and begins its descent of the incline. To control the car in descending, a lever, connected by wires with the brake to the engine drum, is placed at the foot of the trestle approach at the edge of the canal. This lever is operated by a brakeman, who can watch the car and control its speed at will, by simply setting and loosening the engine brake. As there are two independent tracks and cables, there have to be, of course, two brake systems and operators. The view, Fig. 10, shows the brakeman at the edge of the slope. Many of the details of the tipple which are shown in the diagram, Fig. 12, are also shown in this view.

From the foregoing description and the accompanying cuts, a very clear knowledge of the construction and operation of the conveyor may be obtained. The capacity of the conveyor is limited by the capacity of the shovel to handle material. From the records of the Superintendent of Construction we take the following figures of the cubic yards of material handled by each conveyor per ten-hour shift for several months. These figures are all averages of from 50 to 100 shifts.

		Section M, cu. yds.	Section L, cu. yds.
May,	1894	625	750
July,	"	900	800
August,	"	730	730
September,	"	750	810
October,	"	750	945
November,	"	702	702
December,	"	808	808
January,	1895	595	595

On special runs the amount of material handled per hour has been considerably above any of these figures, but from 75 to 80 cu. yds. per hour is thought to be all that can be depended upon day after day in all kinds of weather. The principal advantages claimed for this system of working are simplicity and low cost of the conveying machinery, ease in handling—the conveyor can be moved to take a new cut in 35 minutes—short haul to spoil bank, small number of workmen and the working of the side slopes first, thus enabling this work to be completed during warm weather when the ground is soft, while the center core, which requires little hand labor, is taken out during the cold weather.

Steam shovels are used to fill the cars running on the incline, one shovel being used for each conveyor. Two of the shovels used are Barnhart's A A type, built by the Marion Steam Shovel Co., Marion, O., and two are Bucyrus shovels, built by the Bucyrus Steam Shovel & Dredge Co., South Milwaukee, Wis. Owing to the method of operating and of making the measurements, it is very difficult to secure reliable records of work done by individual shovels. During the eight months from June 6, 1894, to Feb. 6, 1895, one of the Bucyrus No. 0 boom type shovels excavated 276,400 cu. yds. in place. The shovel worked double shift, and the cost for repairs during the eight months was $200. During the month of October, 1894, this same shovel excavated 45,525 cu yds.

Fig. 13. "New Era Grader" at Work on Section K and I, Chicago Main Drainage Channel. Christie & Lowe, Chicago, Contractors; The F. K. Austin Mfg. Co., Chicago, Builders.

The cost of the work thus far done on Sections M and L is divided as follows by the contractors: Coal, 14%; repairs, 14%; excavating, 36%; conveying, 42%. The coal account is chargeable about equally to the excavator and the conveyor. Of the 14% expended for repairs, 8% is charged to the excavator and 6% to the conveyor. This makes 48% of the total cost chargeable to excavating and 52% to conveying.

These figures are based on average results from the 1,200,000 cu. yds. which have been excavated on these sections to date.

The matter from which Figs. 9, 10 and 11 have been prepared has been furnished us by the Heidenreich Co., the contractors for these sections. We are especially indebted to Mr. H. A. Boedker, of

this firm, for aid in securing the notes from which this article has been prepared.

Sections K and I.

The bridge conveyors used to handle the material on Sections K and I by the contractors, Christie & Lowe, of Chicago, Ill., were described in detail in Engineering News, Nov. 15, 1894, and will be referred to only briefly here. Fig. 13 is a general plan of the bridge conveyor plant. Conveyors 1 and 4 work east, and conveyors 2 and 3 work west, Nos. 1 and 2 taking out the top lift, and Nos. 3 and 4 the bottom lift. The arrangement of the dump car and steam shovel tracks, the power houses, etc., are so plainly indicated by the illustration that no further description is necessary.

The capacity of these bridge conveyors to handle material is limited by the capacity of the steam shovels to excavate the hard clay. According to the records of the Superintendent of Construction, the output of the plant has been as follows for five months:

	Section K.		Section I.	
Month.	Shifts.	Cu. yds.	Shifts.	Cu. yds.
September, 1894.....	49	600	92½	555
October, "	49	600	127½	625
November, " 105¾	582	105¾	582
December, "	79	695	79	695
January, 1895.....	59½	557	59½	557

For November, December and January the reports give the total number of shifts worked on both sections, and in the table this number has been divided equally between the two sections. In December and November, 15 shifts and 12½ shifts, respectively, out of the total number of possible day shifts in the month, were lost in delays for repairs, etc. For these same two months all four conveyors worked continuously, except for delays noticed, and their aggregate output for December was 109,805 cu. yds., and for November was 123,000 cu. yds.

Owing to an unavoidable delay in obtaining the necessary machinery for these conveyors, and to keep up with the contract requirement as to monthly progress, 5 ft. in depth over the entire two sections was moved by teams, using wheel scrapers and New Era graders and wagons. The performance of the New Era graders proved especially satisfactory in this top-soil excavation. The construction of this machine is familiar to American engineers, and the accompanying view (Fig. 14) shows clearly the manner of operating it on the drainage channel work. From such figures as are available these graders showed an average output per 10 hours of about 500 cu. yds. Records kept on Section K during August and September, 1894, give the average output as 490 cu. yds. and 515 cu. yds. per 10 hours, respectively. On Section I the average output of each grader for September, 1894, was 485 cu. yds. per 10 hours. The total time worked on both sections was 123 10-hour days, and the average daily force was 50.4 men, 41.9 teams, 22.3 wagons and 3.1 New Era graders. The average output per day worked for each quarter was 508 cu. yds. The material was a fairly soft, clayey loam, and the average haul was about 500 ft. On Section K about 68,300 cu. yds. were removed with wheel scrapers in 62 10-hour days, the average force being 59.6 men, 36.8 teams, 23.9 wheel scrapers and 2 plows. The average output per 10-hour day for each wheel scraper was 46.1 cu. yds.

THE TEMPERATURE OF LAKES.*

By Desmond Fitz Gerald, M. Am. Soc. C. E.

For several years the author has had weekly observations made of the temperature at the surface, mid-depth and bottom of Lake Cochituate, the storage basins and the distributing reservoir of the Boston water-works. These observations for five years have been averaged and studied in connection with more recent records obtained by means of the thermophone, an instrument which allows the temperature at any depth to be read by means of a telephone at the surface. The author has thus been enabled to form an accurate idea of the seasonal changes going on in large bodies of water.

If a pond is less than about 25 ft. deep, the bottom temperature does not vary much from that of the surface. With deeper lakes, however, a different state of things prevails. When Lake Cochituate freezes, the temperature of the bottom is generally near 39.2° in the deep portions. The several strata lie in their order of density, which decreases gradually until within a few feet of the surface, when the temperature falls suddenly to the freezing point adjoining the ice. In a general way, this disposition of the strata remains unchanged after the ice forms until it breaks up in the spring.

As the surface warms up about April 1 to the same temperature as the bottom, the whole body of water is in unstable equilibrium, and circulation takes place from top to bottom under the action of winds and currents. By the first of May, when the surface temperature has risen about 5° above that of the bottom, the difference in density seems sufficient to prevent any further warming of the bottom. While the surface keeps on warming, the bottom remains at very nearly the same temperature throughout the long period of summer stagnation until the middle of November. Some of the effects of this stagnation are remarkable. In a lake with any considerable amount of organic matter in it, and also in deep artificial storage reservoirs, where the surface has not been stripped, the lower layers of water gradually collect all the organic matter from the upper layers, and decay goes on until the oxygen is used up. The water becomes darker and darker, until by October it is very yellow, and generally smells badly.

Between Nov. 1 and Nov. 15 the temperature at the bottom rises 20° to 30° to meet the surface temperature, and then that of the whole mass of water falls at nearly the same rate during a second period of circulation, until freezing begins, which again brings about a condition of stratification. When the November overturning occurs all the bad water in the bottom of the lake or reservoir is brought to the surface, and the infusoria and diatoms begin growing in great numbers, because the organic matter from the bottom and the oxygen of the surface water are brought together and provide food for organic life. The same phenomenon takes place in the spring period of circulation, although on a smaller scale.

* Abstract of paper to be presented at the annual convention of the American Society of Civil Engineers at Nantasket, June 18 to 22.

Freezing quicksand by means of compressed air is being tried by Sooysmith & Co., of New York, on the new Harlem River speedway. The excavation for the retaining wall has to be carried down through a bed of quicksand to a depth of about 40 ft. below the surface. A row of 4-in. pipes is sunk, the pipes being 3 ft. apart, and in each is a smaller pipe, through which the compressed air is carried to the bottom of the large pipe.

TWENTY-NINTH ANNUAL CONVENTION, MASTER CAR BUILDERS' ASSOCIATION.

The first session of this convention was opened at Alexandria Bay, N. Y., June 11, 1895. After an address of welcome by Rev. D. H. Kenyon and some routine business, the President, Mr. J. S. Lentz, delivered his address. He spoke briefly of the character and purpose of the association and the importance of the work which it had before it. Among the features which he considered of paramount interest at the present convention were the report of the committee on interchange and the reports of the two committees on service and laboratory tests of brakeshoes. Among other things recommended to the consideration of the association were the preparation and adoption of standard plans and specifications for 80,000-lb. cars; the use of steel axles; a remodeling of car wheel specifications, so as to insure more reliable material and workmanship; a consideration of the best forms of car doors and car-door fastenings, and a remodeling of the standard wheel treads to fit the heavier rail sections, now in common use. In closing he urged the full attendance of the members at the meetings.

It was voted that the annual dues of members for the coming year be placed at $5. The report of the Secretary, Mr. John W. Cloud, showed the present membership of the association to consist of 214 active, 148 representative, and 5 associate members, making a total of 367 members, or an increase of 33 members during the year. The total number of cars represented by this membership is 1,151,957. The total receipts of the association for the year were $8,811, and the disbursements were $7,788, leaving a balance of $1,023. The report of the treasurer showed the amount of cash on hand to be $4,916. A communication from the International Railway Association was read inviting the Master Car Builders' Association to send a representative to the coming convention in London. The association appointed Mr. R. H. Wilbur, Gen. Supt., Lehigh Valley R. R., as such a representative. After some further routine business, the majority report of the Committee on Interchange of Cars was read by Mr. Pulaski Leeds (L. & N.). This was followed by the minority report, presented by Mr. E. D. Nelson.

Interchange of Cars.

Majority Report.—There has been a tendency during the past few years to place more and more the responsibility for defects in cars upon the owners. The idea is to have cars pass from one road to another, if in safe condition for movement; and that the inspection, in so far as stopping cars at junction points is concerned, shall be made simply for safety. To bring out as fully as possible the ideas of the members of the association, the committee propounded a series of questions. From the answers to these questions it appeared that 28 companies, representing 273,639 cars, were in favor of owners' responsibility, with proper restrictions, and that four companies, representing 26,923 cars, were not in favor of this. As to the number of inspectors which could be dispensed with by placing the responsibility on owners, the answers varied from none to 50%. In many instances it was explained that where a large force of inspectors was employed, some could be dispensed with, but at small points of interchange there could be no reduction of the force. Regarding what should be considered evidence of unfair usage of cars, it appeared from the answers that the mere statement that the damage was not caused by unfair usage should be accepted by the car owner. It was also suggested that clear evidence of damage having occurred very recently should be noted by the inspector, and an interchange card demanded, not as authority for repairs, but as evidence in case of dispute.

From the answers, the majority of the committee thought it appeared safe to assert that there was a large sentiment in favor of placing the responsibility for defects upon owners of cars, with proper exceptions. These exceptions should be along the line of those in what is commonly known as the Chicago rules of interchange.

Minority Report.—This report stated that there were three reasons prompting a minority report: (1) The majority report did not appear to present the whole question; (2) the recommendations in the majority report were not apparently based on logical reasoning from fair premises; (3) the plan recommended was at variance with well-established business principles. The considerations against the Chicago plan of interchange were as follows: (1) That it is opposed to the fundamental principle upon which the M. C. B. rules have been built up and successfully used for many years. This same principle is applied by the business world to every business transaction involving the use of the property of one person by another. The essence of the principle is that the user compensates the owner by the payment of certain sums, which are sufficient to cover the interest on the principle invested, taxes, insurance, ordinary wear and the depreciation which, after the lapse of time renders the original investment valueless. The present M. C. B. rules operate in precisely the same manner. The user of a car belonging to another railway company pays a certain amount per car-mile, and that amount continuously paid during the normal life of the car reimburses the owner in precisely the same manner as in the case with any other leased property. The proposed change in the rules abandons this general and equitable principle, and the owners are asked to furnish cars at practically no expense to the users but the car service rate, in perfect condition for the use on other lines. That condition is gradually impaired by damage often repeated, until the car is no longer fit for service. It is then proposed that any company shall make the necessary repairs at the owner's cost, or return to him a car in an abnormally worn-out condition.

(2) The present mileage rate has been established upon the knowledge of the cost of repairs to foreign cars under the present M. C. B. rules. It would therefore not seem proper to adopt a measure which may very seriously affect the earnings of cars on foreign roads. It is, of course, claimed in the majority report that the bills against owners will not be greater than they are now.' It is then fair to presume that owners have been forced to repair their own cars when returned. The bills, therefore, should be taken in connection with the increased amount of repairs which the owners have been compelled to make before the claim made can be considered fully sustained. It must further be remembered that the period during which the Chicago plan has been in practice is limited, and the car mileage involved is very small as compared with that made by all the railways of the country. Besides this, the experiment has been practically confined to a very congested territory, where prompt interchange, even at increased cost, must be a vital necessity.

(3) The proposed change allows any railway company to repair a foreign car at its option, and to send the bill to the owner, who must honor it. The owner has no means of knowing whether repairs have been properly made, or whether the material is of the kind and quality he would select if he were repairing his own car. In the great majority of cases he will have to take it for granted that the work charged for was done and was legitimately chargeable to the owner of cover the interest on the principal invested, taxes, in the car. This violates usual business precautions.

The reading of these reports was followed by a lively discussion, which continued throughout the session. The main features of this discussion, together with the reports of the various other committees, we postpone to our next issue.

CONTENTS OF SUPPLEMENT.

PERSONALS.....185
ENGINEERING SOCIETIES.....185
Coming Technical Meetings.....185
NEW PUBLICATIONS.....185
CONSTRUCTION NEWS:
List of Contracts Pending.....186
Railways.....186
Street and Electric Railways.....187
Electric Light and Power.....187
Bridges.....188
Buildings.....188
Water-Works.....188
Irrigation.....189
Sewerage.....189
Garbage Disposal.....190
Streets and Roads.....190
Manufacturing Plants.....190
Miscellaneous Contracts and Supplies.....190
Contract Prices.....191
INDUSTRIAL NOTES.....191

PERSONALS.

Mr. Burton J. Ashley has removed his office to 720 Opera House Block, Chicago.

Mr. M. M. Manville has been appointed Water Commissioner at Whitehall, N. Y.

Mr. B. E. Boalt has been appointed Assistant City Engineer of Cleveland, O., and will have charge of the sewer work.

Mr. Joseph Crawford, Superintendent of the New York Division of the Pennsylvania R. R., has gone to California for his health.

Mr. J. S. Mott, of the engineering firm of J. S. Mott & Son, has been appointed City Engineer of Saratoga Springs, N. Y.

Mr. Willis Chipman, M. Am. Soc. C. E., Toronto, Ont., has been appointed engineer of the water-works to be built at Orangeville, Ont.

Mr. Rudolph Hering, M. Am. Soc. C. E., has been appointed Consulting Engineer of the Sewerage Commission of Woonsocket, R. I.

Capt. George M. Gray, General Ticket Agent of the Pullman's Palace Car Co., died at Chicago, Ill., June 1, at the age of 77. He had been in the company's service for 25 years.

Dr. Charles F. McKenna will carry on the laboratories for physical and chemical tests established in this city in 1863 by the late Dr. Gideon E. Moore, with whom Dr. McKenna has been associated. His office is at 221 Pearl St.

Mr. Herman Kroeschell, contractor, of Chicago, Ill., died in that city June 5, at the age of 76. He was born in Cassel, Germany, and came to this country when a boy. He had done work on some of the Chicago water-works tunnels.

Capt. Robert L. Cobb, M. Am. Soc. C. E., Chief Engineer, Ohio Southern R. R., died at Clarksville, Tenn., June 2. He was born in Tennessee in 1841, served in the Confederate Army as Captain of Engineers, and afterwards practiced as an engineer at Little Rock, Ark.

Mr. John D. Fay, of Rochester, N. Y., who died June 6 at the age of 80, had had long experience on the New York State Canals as Division Engineer, Resident Engineer and Canal Commissioner. In 1849 he made a survey for the proposed Nicaragua Canal for Commodore Vanderbilt.

Mr. Edward Murray, who died in Chicago, Ill., June 7, was at one time a Division Superintendent on the Lake Shore & Michigan Southern Ry., and later on the Toledo, St. Louis & Kansas City R. R. Afterward he was connected with the contracting firm of H. H. Lovell, which built the Wisconsin Central Ry. terminal station in Chicago. For the last three years he has been Secretary of the Columbia Theatre. He was born at Geneva, N. Y., in 1846.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMERICAN RAILWAY MASTER MECHANICS' ASSOC'N.
June 17. Annual Convention at Alexandria Bay, N. Y. Secy., Angus Sinclair, 256 Broadway, New York city.
ENGINEERS' CLUB OF MINNEAPOLIS.
June 17. Secy., E. Nexson, Kasota Block.
COLUMBIAN ENGINEERING SOCIETY.
June 18. Secy., W. F. Hart, University Building, 15th and H Sts. N. W., Washington, D. C.
NATIONAL ASSOCIATION OF CAR SERVICE MANAGERS.
June 18. At Cleveland, O. Secy., A. G. Thomason, Scranton, Pa.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 18. Annual meeting at Nantasket, Mass. Secy., C. W. Hunt, 127 E. 23d St., N. Y. city.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
June 19. Secy., F. Van Vleck, Los Angeles, Cal.
WESTERN SOCIETY OF ENGINEERS.
June 19. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.
BOSTON SOCIETY OF CIVIL ENGINEERS.
June 19. Secy., S. E. Tinkham, City Hall, Rooms 36 Bromfield St.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
June 20. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
June 20. Secy., J. F. Wilson, Odd Fellows' Temple.
INDIANAPOLIS ENGINEERING CLUB.
June 22. Secy., C. C. Brown, City Engineer.
WISCONSIN POLYTECHNIC SOCIETY.
June 25. Secy., W. K. Means, Loan & Trust Building, Milwaukee.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
June 25 to 28. Annual Convention at Detroit, Mich., F. R. Hutton, Secy., 12 W. 31st St., New York city.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 25 to 28. At Niagara Falls, N. Y. Secy., B. W. Pope, 26 Cortlandt St., N. Y.
INTERNATIONAL RAILWAY CONGRESS.
June 26 to July 10. At London, England. Secy., F. Weissenbruch, Brussels, Belgium. Secy. of English Branch, W. M. Acworth, London, England.
ENGINEERING ASSOCIATION OF THE SOUTH.
June 27. Secy., H. D. Ruhm, Nashville, Tenn.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
July 9. Secy., F. A. Coburn, Case Library Building.
MONTANA SOCIETY OF CIVIL ENGINEERS.
July 13. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
AMER. ASS'N FOR THE ADVANCEMENT OF SCIENCE.
Aug. 28 to Sept. 7. At Springfield, Mass. Secy., F. W. Putnam, Salem, Mass. Local Secy., Wm. A. Webster, Springfield, Mass.

SCHENECTADY TECHNICAL SOCIETY.—At the regular monthly meeting on June 3 a paper was read by Prof. Elton D. Walker, of Union College, on "The Uses of Photography in Surveying." He described the methods of obtaining bird's-eye views by photography, and also of estimating quite accurately the distances upon a photographic survey. He described the methods used in the survey of the National Park and by the Canadian Corps in Manitoba.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The general meeting will be held at the Cataract House, Niagara Falls, N. Y., beginning on Tuesday, June 25, and continuing four days. The following papers will be presented: "The Substitution of Electricity for Steam in Railway Practice," inaugural address by the President, Dr. Louis Duncan, of Baltimore; "Properties of Fuse Metals when Subjected to Short Circuits," Walter E. Harrington, of Camden, N. J.; "Location of Grounds in Armatures, Fields, Etc.," Clarence E. Gifford, of Jamestown, N. Y.; "Some Features of Alternating Current Systems," Chas. P. Steinmetz, of Schenectady, N. Y.; "Theory of General Alternating Current Transformers," Chas. P. Steinmetz, of Schenectady, N. Y.; "Compounding Dynamos by Armature Reaction," Elihu Thomson, of Lynn, Mass.; "Existing Commercial Applications of Electrical Power from Niagara Falls," W. L. R. Emmet, of Schenectady, N. Y.; "Alternating Current Curves," Dr. C. E. Emery, of New York; "Electric Power in Factories," Prof. Francis B. Crocker and Messrs. Benedikt and Ormsbee, of New York; "Some Observations on a Direct Connected 300-Kilowatt Monocyclic Alternator," Profs. Dugald C. Jackson and S. B. Fortenbaugh, of Madison, Wis.; "On Mechanical Models of the Electric Current," Prof. Brown Ayres, of New Orleans, La.; "On the Cause of Death in Electric Shock," Albert M. Bielle, M. D., of Columbus, O.; "Long-Distance Power Transmission at 10,000 Volts (the Pomona Plant)," George Herbert Winslow, of Pittsburg, Pa.; "Notes on the Reconstruction of a Small Central Station Plant," Franklin Leonard Pope, of Great Barrington, Mass.; "On Rating the Performance of Electric Power Plants and Transmission of Varying Loads," Prof. Wm. S. Aldrich, of Morgantown, W. Va.; "Work of the Westinghouse Electric & Mfg. Co. for the Cataract Construction Co., of New York," L. B. Stillwell, of Pittsburg.

Among the objects of engineering interest which it is proposed to visit are the new works of the Niagara Falls Power Co., the Niagara Falls Park & River Ry. on the Canadian side; the aluminum plant of the Pittsburg Reduction Co., the plant of the Carborundum Co. and the central station of the Niagara Falls & Buffalo Electric Light & Power Co.

ENGINEERS' CLUB OF PHILADELPHIA.—At the meeting on June 1, a special committee co-operating with the committee on standard gages for sheet metal of the American Society of Mechanical Engineers favored the adoption of the proposed decimal gage with dimensions expressed in thousandths of an inch. It did not, however, consider the unification of the inch and meter standards practicable at present. Mr. George H. Paine read a paper on "Certain Interesting Features in the Manual Interlocking of Railways." Mr. Emile Geyelin described what he believed to be the first pair of turbines working on the same horizontal axis. These turbines were made by him in 1854 for a cotton mill at Palitas, Mexico. They were 11 ins. in diameter, made 1,850 revolutions per minute under 160 ft. head of water, and were connected to a countershaft by spun wheels to attain a speed of 185 revolutions per minute. Their action was very satisfactory.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on June 5, Mr. Edward Flad addressed the club on the subject of stand-pipes, making special reference to a tower designed by him and just completed at St. Charles, Mo. Its dimensions are 25 ft. diameter by 70 ft. high; capacity, 250,000 gallons. It is encased in brickwork tied to the tower itself. The stand-pipe is stiffened by six circular girders, the object of which is to maintain the circular shape of the tower, so as to afford maximum strength to resist wind pressure. These girders are on the outside of the tank, occupying the space of 2 ft. between the tower itself and the casing. A stairway was also placed in this space. The stand-pipe is covered by a roof of iron and slate. Due attention had been given to architectural features. The cost of the stand-pipe was as follows: For ironwork, $4,450; brickwork, $2,807; foundation, $677; total, $7,934. Mr. Flad also showed a tower designed by him for Laredo, Tex., and showed views of the St. Charles, Laredo, and other towers of recent design, as well as a number of towers which have failed.

NEW PUBLICATIONS.

JUNE MAGAZINES.—In "The Century" this month John Muir describes in most entertaining style the discovery of Glacier Bay in Alaska, and the wonderful sights that the explorer who visits it may see. In "Harper's" Hon. Seth Low, President of Columbia College, under the title "Some Questions of the Day," writes a most valuable statement of what may be called the hopeful side of the labor union movement. Starting by calling attention to the recent indorsement of civil service reform by some representative labor organizations in Chicago, he points out, what is too often overlooked, that organization among laborers is inevitable, and is entirely in accordance with the tendency toward concentration and consolidation which characterizes the modern industrial system. "The two forms of combination, the combination of capital and the combination of labor, are not antagonistic; they are only different expressions of the same force." President Low says further, that even such uprisings of labor organizations as that at Chicago a year ago have not that insidious danger to our civilization and its institutions that characterizes such evils as the systematic bribing of legislators. All who are interested in the progress of Russia should read the paper in "Harper's" on "The New Czar and What We May Expect from Him." In brief, if what the writer says is true, and he claims to speak with authority, we may expect from the new Czar a reign of marked liberality and progress, and one of no small contrast to the reactionary reign of his father.

In "Scribner's" Melville E. Stone writes on "Chicago Before the Fire, After the Fire and To-day." There is also a symposium on the bicycle, which will interest those who are noting the influence which the silent steed is having, and is likely to have, in the solution of various social problems. In "McClure's Magazine," Cleveland Moffett describes the great Du Pont powder mills. We quote at follows:

The Du Ponts monopolize the gunpowder business of America, controlling 28 of the 32 mills in the country. They do this by confiding to no one, not even to the archives of the Patent Office, their secret methods of composition, their specially-devised machinery, and all the lore of gunpowder making that has come to them through generations. This inherited knowledge is the family treasure, and to guard it inviolate, the Du Ponts must be their own mechanics, superintendents and engineers, must spend hours every day in the mills; must live with the menace of sudden and frightful death always before them.

In "The Popular Science Monthly" Mr. H. T. Newcomb writes of "The Decline in Railway Charges." He holds that further reductions in the returns to the capital invested in railways are not feasible, and that the only way to meet the constant pressure for further reductions in the freight charges is by reducing cost of railway operation through further consolidation of railway properties, actual or tacit. "If necessary, the means of governmental regulation should be strengthened, and the operation of the consolidated properties brought more into harmony with public interests. If, as a final result, it should appear that absolute government ownership is safe, practicable, and likely to be productive of much good, it is not unduly optimistic confidently to expect that our institutions will be found perfectly adequate for the new task."

"The Power and Wealth of the United States" is the subject of a paper by M. G. Mulhall, the famous statistician, in the June number of the "North American Review." J. Henniker Heaton, M. P., writes on "A Cable Post." He points out that whereas there are a dozen working cables between America and England, a single one, which could be laid at present at a cost of some $2,500,000, is by some cable experts considered capable of handling all the traffic. Mr. Heaton says that two cables could certainly handle the business and the interest on their cost would be at most $250,000 per annum and the working expenses would be about $400,000. In other words, the public could get, if it paid actual cost, the same service for $650,000 that it now pays $5,000,000 per annum to obtain. Mr. Heaton would have the British and American governments jointly acquire the rights of the existing cable companies and reduce cable tolls to 2 cts (1 penny) per word. He believes that an enormous increase in the use of the cable would at once result. Gen. John Gibbon, U. S. A., writes on "How to Make West Point More

Useful." He would abolish the present system of entrance examinations and apply at the end of six months the test as to whether the appointees "have any qualifications as soldiers." He would also increase the number of students at West Point by restoring the right of the President to appoint 10 each year and giving one appointment to each U. S. Senator. Whether the proposed increase in the number of West Point students be advisable or not, the proposition to abolish entrance examinations as a requisite for admission seems little likely to meet with favor. As the case stands now, the youth desirous of entering West Point must not only have influence enough to secure the nomination by his Congressman, but must also have brains enough to pass the rigid entrance examinations.

In the "Forum" E. L. R. Gould writes on "The Only Cure for Slums," which is, in brief, to house slum inhabitants in quarters that shall make them no longer slum dwellers. He reviews English experience in this work as the best guide to American progress in the same direction. The number also has an interesting paper on "College Finances." The writer estimates the wealth of American colleges and universities as at least $200,000,000. It is of interest to note that the University of Oxford has an income of nearly $2,500,000. In the "Review of Reviews," we find an entertaining account of Chicago newspapers and their makers.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
June 14.	Stone and brick work at Richmond, Ky.		May 23
June 14.	Bridge, Central City, Neb.		May 23
June 14.	Water-works system, Montgomery, N.Y.		May 23
	Advertised, Eng. News, May 23 to June 6.		
June 14.	Pipe sewers (10,160 ft.), Maywood, Ill.		June 6
June 14.	Cement sidewalks, Washington, D. C.		June 6
June 14.	Road improvmt bonds, Belleville, N. J.		June 6
June 14.	Laying water pipe, Belmont, Mass.		June 13
June 15.	Irrigation canal, Portland, Ore.		Apr. 18
June 15.	Sinking wells, Norfolk, Va.		May 16
	Advertised, Eng. News, May 16.		
June 15.	Water bonds, Canandaigua, N. Y.		May 16
June 15.	Street improvements, Avondale, O.		May 23
June 15.	Sewer, Emporium, Pa.		May 23
	Advertised, Eng. News, May 23.		
June 15.	Steel bridges (2 contracts), London, Ont.		May 23
	Advertised, Eng. News, May 23 to June 6.		
June 15.	Electric l't plant, Scotland Neck, N. C.		May 30
June 15.	Railway (11½ miles), Philipsburg, Pa.		May 30
	Advertised, Eng. News, June 6.		
June 15.	Brick paving, Logansport, Ind.		May 30
June 15.	Iron cage, Pulaski, Tenn.		May 30
June 15.	Bridge masonry, Painesville, O.		June 6
June 15.	Stone culverts, L. & P. S. Ry, Ont.		June 6
June 15.	Laboratory, Wooster, O.		June 6
June 15.	Theater bldg. work, Atchison, Kan.		June 6
June 15.	Electric railway route, Marion, O.		June 6
June 15.	Pipe sewers, Charleroi, Pa.		June 13
June 15.	Bridge, Williamsport, Pa.		June 13
June 15.	Office building, Wheeling, W. Va.		June 13
June 17.	Building supplies, Washington, D. C.		May 23
June 17.	Electric lighting, Scottdale, Pa.		May 23
	Advertised, Eng. News, May 23 to June 13.		
June 17.	Viaduct (642 ft.), Albany, N. Y.		May 23
June 17.	Belgian block paving, Jersey City, N. J.		May 30
June 17.	Steel viaduct, JerseyCity, N. J.		May 30
June 17.	Brick paving, Jersey City, N. J.		May 30
June 17.	Sewer, Rochester, N. Y.		June 6
June 17.	Sewer system, Pelham Manor, N. Y.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 17.	Pipe sewers (26,000 ft.), Clinton, N. Y.		June 6
	Advertised, Eng. News, June 6.		
June 17.	Flagging (33 contracts), Brooklyn.		June 6
June 17.	Brick paving, Cincinnati.		June 6
June 17.	Macadamizing (6,250 lin. ft.), Albany.		June 13
June 17.	Court house improvem'ts, Brooklyn, N.Y.		June 13
June 17.	School bldg improvem'ts (13), New York.		June 13
June 17.	Brick sewers, Syracuse, N. Y.		June 13
June 17.	Grading, etc., Syracuse, N. Y.		June 13
June 17.	Street sprinkling, Syracuse, N. Y.		June 13
June 17.	Stone arch bridge, Syracuse, N. Y.		June 13
June 17.	Pipe sewers, Jersey City, N. J.		June 13
June 17.	Macadamiz'g (46,100 sq.yds.), Jersey City.		June 13
June 17.	Water ext'n (3,700 ft.), Jersey City, N.J.		June 13
June 17.	Stone paving (12,300 sq.yds.), Jersey City.		June 13
June 17.	Grading, Bellevue, Pa.		June 13
June 17.	Macadamiz'g (18,000 sq.yds.), Dubuque, Ia.		June 13
June 18.	Paving, etc., Mattoon, Ill.		May 30
June 18.	Sale of disinfecting plant, New York.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 18.	Elevators, Washington, D. C.		June 6
June 18.	Water bonds ($200,000), Portland, Ore.		June 6
June 18.	Ferry drop, Boston, Mass.		June 13
June 18.	Grading, Newburg, N. Y.		June 13
June 18.	Rivets, steel plates, etc., for N.Y. navy yd.		June 13
June 18.	Dynamo, etc., Philadelphia, Pa.		June 13
June 18.	Sewer, Pittsburg, Pa.		June 13
June 18.	Purchase of stand-pipe, Dallas, Tex.		June 13
June 19.	Water-works system, Pawhuska, Okla.		May 16
June 19.	Bridge mas'ry, (5 cont's), Norristown, Pa.		May 23
June 19.	Steel bridge, Ironton, O.		May 23
June 19.	School building, Cleveland, O.		May 30
June 19.	Electric lighting, Lexington, Ky.		May 30
June 19.	Sewers (6,590 ft.), Plainfield, N. J.		May 30
	Advertised, Eng. News, May 30.		
June 19.	Water-works, Independence, Wis.		May 30
June 19.	Wharf, etc., Southport, N. C.		June 6
June 19.	Electric light plant, Collingwood, Ont.		June 6
June 19.	Macadamizing (50 m.), Morristown, N.J.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 19.	Water-works system, Monticello, N. Y.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 20.	Electric light plant, Athens, O.		May 23
June 20.	Bridge bonds ($20,000), Dayton, O.		May 23
June 20.	Fence, Columbus, O.		May 23
June 20.	Electric light plant, Los Angeles, Cal.		May 30
June 20.	Iron bridge, Galveston, Tex.		May 30
June 20.	Court house, Paris, Tex.		May 30
June 20.	Public bldg. work, Washington, D. C.		June 6
June 20.	Electric subway conduits, Baltimore.		June 6
June 20.	Iron bridges (2 contracts), Houston.		June 6
June 20.	Sewer, New York, N. Y.		June 13
June 20.	Grading, New York, N. Y.		June 13
June 20.	Dam, etc., Philadelphia, Pa.		June 13
June 20.	Road, Philadelphia, Pa.		June 13
June 20.	Bridge superstructure, Scranton, Pa.		June 13
June 20.	Cast iron pipe, Washington, D. C.		June 13
	Advertised, Eng. News, June 6.		
June 20.	Grading, Dayton, O.		June 13
June 20.	Water-works system, Alta, Ia.		June 13
June 20.	Water bonds ($10,000), Sherburne, Minn.		June 13
June 20.	Dam, etc., Montreal, Que.		June 13
June 21.	Water-works system, Kenwood, Ill.		May 23
	Advertised, Eng. News, May 23.		
June 21.	Bridge superstructure, Buffalo, N. Y.		May 30
June 21.	Iron bridge, Cape Girardeau, Mo.		May 30
June 21.	Sewer, Cincinnati, O.		May 30
June 21.	Pipe sewers, etc., Rochester, N. Y.		June 13
June 21.	Paving, etc., Pittsburg, Pa.		June 13
June 21.	Pipe sewers, Pittsburg, Pa.		June 13
June 21.	Pig lead (100 tons), Buffalo, N. Y.		June 13
June 21.	Sewer, North Elba, N. Y.		June 13
June 21.	Bridge work, Easton, Pa.		June 13
	Advertised, Eng. News, June 13.		
June 21.	Pipe sewers, Omaha, Neb.		June 13
June 22.	Road improvement, Cincinnati, O.		June 6
June 22.	Sewers (28,125 ft.), Ithaca, N. Y.		June 13
	Advertised, Eng. News, June 6 and 13.		
June 22.	Brick paving, Wilkinsburg, Pa.		June 13
	Advertised, Eng. News, June 13.		
June 22.	Bridge, Cincinnati, O.		June 13
June 22.	Asphalt paving, Indianapolis, Ind.		June 13
June 24.	Court house plans, Denton, Tex.		May 30
June 24.	Garbage disposal, Washington, D. C.		May 30
June 24.	Iron piles, San Francisco, Cal.		June 6
June 24.	Paving, Piqua, O.		June 6
June 24.	Sewers, Binghamton, N. Y.		June 13
June 24.	Fire engine house, Brooklyn, N. Y.		June 13
June 24.	Water-works system, Earlville, Ill.		June 13
June 25.	Water-works system, Wapakoneta, O.		June 6
	Advertised, Eng. News, June 6 and 13.		
June 25.	Pipe sewers, Buffalo, N. Y.		June 13
June 25.	Paving, Williamsport, Pa.		June 13
	Advertised, Eng. News, June 13 and 20.		
June 25.	Heating, etc., at Charleston, S. C.		June 13
June 25.	Water-works system, Perrysville, O.		June 13
	Advertised, Eng. News, June 13.		
June 25.	Brick paving, Hammond, Ind.		June 13
June 25.	Brick sewers (4,700 ft.), Hammond, Ind.		June 13
June 25.	Water-works system, Goliad, Tex.		June 13
June 26.	Court house and jail, Swainsboro, Ga.		May 16
June 26.	Street ry franchise, Los Angeles, Cal.		June 6
June 26.	Macadamizing at Fort Crook, Neb.		June 6
June 26.	Reservoir, etc., New Bedford, Mass.		June 13
	Advertised, Eng. News, June 13.		
June 26.	Lighthouse work, Round Island, Mich.		June 13
June 26.	Water-wks system, Stewartville, Minn.		June 13
June 27.	Jetty work, Montgomery, Ala.		May 16
	Advertised, Eng. News, May 16 to June 6.		
June 28.	Building, Faribault, Minn.		June 6
June 28.	Hire of dredge, New Orleans, La.		June 6
June 28.	Pumping machinery, San Francisco, Cal.		June 13
June 29.	Wooden bridge, Cape Girardeau, Mo.		June 6
June 30.	Jail, Wilkes Barre, Pa.		June 13
July 1.	Water-works system, Deckertown, N. J.		May 30
	Advertised, Eng. News, May 30 to June 13.		
July 1.	Water-works system, Cullman, Ala.		May 30
July 1.	Crib dike, Wilmington, Del.		June 6
July 1.	Water supply, Jersey City, N. J.		June 6
July 1.	Road construction, Bristol, Me.		June 6
July 1.	Sewers, (9½ miles), Grinnell, Ia.		June 13
	Advertised, Eng. News, June 13 to 27.		
July 2.	Brick paving, Van Wert, O.		May 30
July 2.	Water-w'ks franchise, Greenville, Miss.		May 30
July 2.	Garbage removal, Harrison, N. J.		June 13
July 2.	Water bonds ($7,000), Port Clinton, O.		June 13
July 2.	Dredging, Raleigh, Ont.		June 13
July 3.	Bridges, Ukiah, Cal.		Apr. 18
July 3.	Electric railway sale, Beatrice, Neb.		June 13
July 5.	Stone culvert, Columbus, O.		June 13
July 5.	Sewers, Mattoon, Ill.		June 13
July 5.	Brick paving, Mattoon, Ill.		June 13
July 5.	Water-wks system, Cornwall-on-Hudson.		June 13
	Advertised, Eng. News, June 13 to July 4.		
July 6.	Jail cells, Auburn, Cal.		May 16
July 6.	Brick arch, Mansfield, O.		June 13
July 8.	Courthouse, Baltimore, Md.		May 9
	Advertised, Eng. News, May 9 to 23.		
Aug. 2.	Electric lighting, El Paso, Tex.		May 23
July 8.	Buildings, Lafayette, Ind.		June 13
July 9.	Steel water tank, Cincinnati, O.		June 13
Aug. 5.	Plans for state capitol, St. Paul, Minn.		Apr. 25
Oct. 1.	Plans for art building, Philadelphia, Pa.		May 23
	Advertised, Eng. News, May 23 to June 27.		
No date.	Water ext'n (16-in.), Willard, N. Y.		June 13
"	Engine and dynamos, Newark, N. J.		May 30
	Advertised, Eng. News, May 30 to June 20.		

RAILWAYS.

East of Chicago.

BUFFALO & ST. MARY'S.—Incorporated in Pennsylvania June 5 to build a railway from St. Mary's, Elk county, Pa., to Ketner, on the New York, Lake Erie & Western, and to Clermont, on the Western New York & Pennsylvania, a distance of 30 miles; capital stock, $300,000; Pres., B. Frank Hall, St. Mary's, Pa.; other directors, Andrew Kaul, B. E. Mittendorf, J. H. Kaul, G. C. Simons and J. M. Schaefer, of St. Mary's, and J. K. P. Hall, of Ridgeway.

BOSTON & MAINE.—H. Bissell, Ch. Engr., Boston, is reported as stating that working plans have been made for abolishing a dangerous grade crossing at Charlestown, Mass., by the construction of a long viaduct on each side of the Miller River, with an iron drawbridge over the stream 22 ft. above the present line.

CHICAGO, INDIANAPOLIS & CHATTANOOGA SOUTHERN.—It is reported that grading has been completed from Rockport, Ind., northerly about five miles to Grandview, Ind. Ch. Engr., C. H. Wright, 723 Rookery Bldg., Chicago.

EPWORTH LEAGUE.—This railway has been completed between Ludington, Mich., and the assembly grounds on Lincoln Lake, about five miles, and there is talk of extending the road to Hamlin Lake, a distance of about three miles.

ERIE & CENTRAL NEW YORK.—The Cortland, N. Y., "Standard" states that Chas. H. Benson, of Cortland, has a large force of men engaged to begin work on this railway.

GLOVERSVILLE & BROADALBIN.—The state railroad commission has granted this company authority to construct its proposed road. Ch. Engr., J. W. Cleveland, Broadalbin, N. Y.

HARDWICK & WOODBURY.—The construction of this railway has been commenced at Hardwick, Vt. The line will be about seven miles in length. Pres., G. M. Powers, Morrisville, Vt.

NIAGARA, HAMILTON & PACIFIC.—The city of St. Catharines, Ont., is considering a by-law granting this company a bonus of $80,000 in 5% 20-year bonds on condition that a railway be completed between that city and Hamilton within 20 months. A press report states that this is a proposed reorganization of the Hamilton Radial and Niagara Central projects and that the company is to run two trains daily each way between Hamilton and Niagara through St. Catharines; that for the remainder of the period of 20 years, from Oct. 1, 1888, the company shall carry coal by the carload from Niagara to St. Catharines at not a greater rate than 25 cts. a ton; that a branch repair shop shall be maintained in St. Catharines for a period of not less than 20 years from the completion of the road to Hamilton; that steam shall be the motive power between the Niagara River and Hamilton, and 72-lb. rails shall be used between St. Catharines and Hamilton; and that the railway shall not be sold or leased or amalgamated with the Grand Trunk. The city already holds $80,000 worth of Niagara Central bonds, which it is proposed to exchange for bonds of the new company.

NORWALK & FAIRFIELD.—The city council of Norwalk, O., has passed an ordinance granting a franchise to S. E. Crawford and others for this suburban railway, to be operated by a steam motor, according to press reports.

OLEAN, OSWAYO & EASTERN.—Grading is reported to have commenced on the extension from Genesee, Pa., through West Union and Greenwood to Canisteo, N. Y., a distance of 27 miles. Pres., J. B. Rumsey, Oswayo, Pa.

OTTAWA, ARNPRIOR & PARRY SOUND.—It is reported that the third ten miles of the Parry Sound Ry. from Loup Lake, Ont., west, will be put under contract at an early date. Pres., C. J. Booth, Ottawa, Ont.

PITTSBURG, MONONGAHELA & WHEELING.—Press reports state that A. D. Neeld, Ch. Engr., has commenced work at Monongahela, Pa., on the final location for this railway, which will extend west from that city through a rich tract of coal fields, 40,000 acres of which are owned by the Monongahela Coal Co.

PLYMOUTH COUNTY.—Contracts for building this railway will be awarded at once. E. Worthington, Ch. Engr., 342 Exchange Bldg., Boston, writes us that the surveys have been completed and right of way secured. The road will be 25 miles in length, connecting Weymouth, Hingham, Newell, Hanover, Marsfield and Pembroke, Mass. Pres., John F. Simmons, 32 Equitable Bldg., Boston.

TROY & NEW ENGLAND.—The contract for building this railway from Albia (Ward 5 of Troy, N. Y.) to Averill Park, 10 miles, is noted under Street and Electric Railways. The line will be built so that it can be used as a steam road, as well as electric, and we are informed that it is the intention to extend it to the state line and to Kinderhook at an early date. T. Wm. Harris, of New York, has the contract for the grading, bridge building, etc., and commenced the construction June 10. The surveys were made by Prof. Wm. G. Raymond, of the Rensselaer Polytechnic Institute, Troy. J. J. Tillinghast, Treas.

WATERVILLE & WISCASSET.—The city of Waterville, Me., at the election last week, refused to vote aid to this railway, and it is stated that the project will probably be abandoned for the present. There is now talk of building a narrow gage line from Fairfield to Benton Falls and thence to Albion to connect with the Wiscasset & Quebec, a distance of 8 miles.

Southern.

ABERDEEN & WEST END.—It is reported that the grading on the extension under construction from Candor to Troy, N. C., by way of Star, 17 miles, has been completed from Candor to Star, eight miles, and that work is in progress between Star and Troy. Ch. Engr., J. R. Page, Aberdeen, N. C.

BRISTOL, ELIZABETHTON & NORTH CAROLINA.—A correspondent writes us that this railway, which extends from Bristol to Elizabethton, Tenn., and which was sold a few days ago to the Pennsylvania Steel Co., will be extended to Asheville, N. C., from Elizabethton, Tenn.

DOUGLAS, & McDONALD.—This road is now in operation from Douglas to McDonald's Mill, Ga., 19 miles, according to reports. It connects with the Brunswick & Western, a part of the Plant system, at McDonald's Mill. The line is laid with 65-lb. steel rails. J. S. Bailey, McDonald's Mill, Ga.

GREENVILLE, NASHVILLE & CHATTANOOGA.—Geo. H. Bunch, Vice-Pres. and Gen. Man., Memphis, Tenn., writes us that contracts for completing the grading and laying the track on the Corinth & Tennessee River division of this road will soon be awarded. The line is projected from Corinth township to Hamburg, Tenn., 18½ miles, of which seven miles are already graded. The line is to be completed by Sept. 1. Ch. Engr., R. B. Richardson; Pres., F. L. Bates, both of Memphis, Tenn.

MONTGOMERY, HAYNEVILLE & CAMDEN.—S. D. Block, Pres., Montgomery, Ala., is reported as stating that the construction of this railway will be commenced about July 1. The right of way has all been secured.

PENSACOLA NORTHERN.—A press report from Pensacola, Fla., states that the capital has been secured to construct this railway, which has been projected for several years, from that city to Memphis, Tenn., 432 miles. It is expected that the contract for the first 10 miles will be awarded within a few days. Pres., S. N. Praag, Pensacola, Fla.

POINT PLEASANT, BUCKHANNON & TYGARTS VALLEY.—This company was incorporated a few years ago to build a railway from Bellington, W. Va., the terminus of the Baltimore & Ohio, to Buckhannon, on the West Virginia & Pittsburg, and thence to Point Pleasant, about 200 miles. A preliminary survey of the first 20 miles, from Bellington to Buckhannon, was made by L. A. Mullins, Ch. Engr., Buckhannon, W. Va., and a bonus of $30,000 was secured. The Baltimore & Ohio has now secured a controlling interest

ig the project, and we are informed that the first 20 miles will probably be constructed without delay. Pres., John Bradshaw, Grafton, W. Va.

RALEIGH & WESTERN.—A correspondent writes us that this road is to be extended from Colon, a station on the Raleigh & Augusta (Seaboard Air Line system), to Asheboro, N. C., the county seat of Randolph county, at an early date. Pres. and Man., S. A. Hensley; Acting Ch. Engr., E. G. Segroves, both of Egypt, N. C.

WILMINGTON & BRANDYWINE SPRINGS.—The Wilmington, Del., "Star" states that R. A. Carswell, of Elsmere, has made surveys of three routes for the proposed Wilmington & Brandywine Springs Ry. The surveyors of the construction company which will build the road have gone over the routes, but have not yet determined which of them they will decide upon. It is expected that the construction will be commenced this month.

Northwest.

BOONE VALLEY COAL & R. R.—Hamilton Browne, Pres., Boone, Ia., is reported as interested in a railway soon to be built from Sioux City to Gowrie, a distance of about 45 miles through the northern portion of Boone county, Ia.

CALUMET & BLUE ISLAND.—The city council of Chicago, Ill., on June 3 passed an ordinance giving this company right of way along the lake front for an extension from 95th St. to the Indiana state line. Ch. Engr., C. E. Dearborn, South Chicago, Ill.

CHICHAGO, MILWAUKEE & ST. PAUL.—This company is reported as having decided to build an extension north from Berlin, Wis., through the eastern part of Waushara county, touching Fremont and Weyauwega, in Waupaca county, and thence to Manawa and up the Little Wolf River Valley to Wausau. Ch. Engr., D. J. Whittemore, Chicago, Ill.

GREEN BAY, WINONA & ST. PAUL.—Green Bay, Wis., papers state that surveys are being made for an extension of this railway from Scandinavia to Waupaca. Supt., F. B. Seymour, Green Bay, Wis.

LANGENBURG & SOUTHERN.—It is reported that Andrew Allan, Hugh A. Allan, Andrew A. Allan, James B. Allan and A. A. McKenzie, of Montreal, Que., and Bryce T. Allan, of Boston, are applying for a charter for this company, for a railway to connect Langenburg, in Assiniboia, with the Canadian Pacific line between Red Jacket and Elkhorn.

WISCONSIN & CHIPPEWA.—About seven miles of the Spirit River extension is now ready for tracklaying. Secy., F. G. Stark, Tomahawk, Wis.

WISCONSIN CENTRAL.—Regarding the reported extension of the Greenwood branch, a press report states as follows: It is a foregone conclusion that the road will be put through the coming summer. An agreement is reported to have been made between the Foster Lumber Co., of Fairchild, and the railway company whereby Mr. Foster is to have his road completed to connect with this extension. The Fairchild road would intercept the Central just across Black River, but it is not probable that the Central people would bridge that river simply to get the shipping of the Foster company, and will without doubt push the road on to Bateman. Preparations are being made to do some building, but just how much is not known.

Southwest.

BELTON & NORTHEASTERN.—Press reports from Belton, Tex., state that this company has been organized at that place with a capital stock of $500,000. A charter will be applied for at once, and engineers placed in the field to make preliminary surveys from Belton for a connection with the St. Louis Southwestern. An assessment of 5% has been levied for the purpose of surveys. The distance to McGregor is only 28 miles, and it is thought that a railway could be built over that route at a small cost. Pres., G. W. C. Pendleton; Vice-Presidents, J. Z. Miller, Sr., H. C. Denny and B. A. Ludlow; Treas., J. Z. Miller, Jr.; Gen. Man., N. K. Smith; Secy., Henry Austin.

DALLAS BELT LINE.—G. Howard Ellers, Pres. and Ch. Engr., Chicago, writes us that surveys have been made, right of way and terminal facilities secured, and that in July or August the company will do the grading and tracklaying. The road will be 15 miles in length and operated by steam.

HUTCHINSON & SOUTHERN.—Press reports claim that on June 20 the construction of this railway will be commenced at Guthrie, Okla., and Gainesville, Tex., and that as soon as these cities are connected the line will be extended to Cameron, Kan. The road is now in operation from Hutchinson to Cameron, Kan., 82 miles. Receiver, B. Roberts, Topeka, Kan.

TEXAS MIDLAND.—E. H. R. Green, Pres., Terrell, Tex., is quoted as stating that this railway will be extended from Paris to Waxahachie as soon as the Paris extension is completed.

Rocky Mt. and Pacific.

BUTTE & RENO.—Press reports from Boise City, Idaho, state that H. H. Daniels, representing Denver parties, and capitalists from New York and elsewhere, are arranging for the construction of a railway to connect the Montana country and Idaho with San Francisco, probably by a connection at Reno, Nev. The line will cross the Rocky Mountains at Lemhi Pass, strike the Lemhi River, go up the Salmon through the famous Challis mining country, following down the Yellow Jacket, Clayton and Stanley Basin country, cross near Sawtooth Lake over to Atlanta, and Rocky Bar and down to Boise, then taking a southwesterly course to Silver City, De Lamar and Southeastern Oregon, to Reno, Nev. The line has already been gone over by a corps of engineers and found to be favorable in all respects to the building of the road. At no point does the elevation exceed 4,650 ft., and from Boise City to Reno the grade is only 1,400 ft. in 80 miles.

DETROIT COPPER CO.—This company, of Morenci, Ariz., is reported as having surveys made for a railway from that place to Solomonville, Ariz., to connect with the Gila Valley, Globe & Northern.

GREAT NORTHERN.—The Spokane, Wash., "Chronicle" states that this company has awarded contracts for 265,000 ties to be delivered along its line in Eastern Washington by June 15, and that it is claimed that these will be used in making repairs and building branches. The ties are to be supplied by A. S. Cary, of Seattle; Stimson Mill Co., of Seattle; Empire Mill Co., of Saxon, Wash.; Bellingham Bay Improvement Co., of Whatcom; W. A. Wooding, of Fairhaven; J. E. Bell, of Everett; Q. E. Friar, of Lowell; Davidson & Millock, of Woolley; Skagit River Lumber & Shingle Co., of Woolley, and Marvin Bros., of Snohomish.

MONTANA.—Incorporated in Montana to succeed the Montana Midland. According to the laws of Montana, if a railway company fails to build and operate 20 miles of its line the first year of its existence, a new charter has to be secured. The Montana Valley, the Helena & Castle, the Helena, White Sulphur Springs & Castle and the Montana Midland have all been incorporated within a few years to build a railway from Helena, at a tidewater elevation of 4,100 ft., with descending grade to the Missouri River at 3,000 ft., then up the Big Belt Mountains at 5,800 ft., thence with elevations of 4,200 ft., 6,000 ft. and 3,000 ft. on to White Sulphur Springs and the Castle mining district, a distance of 125 miles. It is stated that the new company has purchased the 18 miles of graded roadbed of the Montana Midland, and that it will issue $1,250,000 in bonds to build the road from Helena to the Castle mining district. A trust deed has been given to the Central Trust Co., which will issue $120,000 in bonds as soon as the mortgage is recorded. When the 30 miles have been completed from a point on the Northern Pacific near Townsend toward Castle, $180,000 more; when the next 15 miles have been built, $150,000 more; and for each mile in excess of the 45 mentioned, $10,000 more; on the completion of 10 miles from Helena towards Townsend, $100,000; and for each additional mile when the road shall have been completed between Helena and Townsend, $10,000. The route is as follows: From Helena in a northeasterly direction to the Missouri River at a point near the mouth of Spokane Creek; thence southeast to near the mouth of Sixteen Mile Creek; thence northeast to the Castle mining district; capital stock, $3,500,000; incorporators, Cutler Whitney, of New York; William J. Fuchs, A. G. Lombard, John D. Wilson and M. S. Gunn. The officers are M. S. Gunn, president, and W. J. Fuchs, secretary.

SAN FRANCISCO & SAN JOAQUIN VALLEY.—Press reports state that the surveys for this railway are progressing rapidly, and that the third cargo of rails has been shipped from New York.

STOCKTON & LODI.—Surveys are being made for a broad gage dummy line between Stockton, Cal., and Lodi, according to reports.

Foreign.

MEXICO.—A press report from the city of Mexico states as follows: The Mexican Central Ry. Co. has decided to extend its Guadalajara branch from Guadalajara to Ameca, 50 miles west. The line has been surveyed, and work will be begun next month. This is the first step toward completing the line through to San Blas, on the Pacific Coast.

President Diaz has approved the concession granting the Mexican Western R. R. Co. authority to construct a line from Culican, Sinaloa, to Salinas del Penon Blanco, where it will connect with the Mexican Central. The line will traverse the Sierre Madre, touching Fresnillo, Durango and other important cities. The headquarters of the company will be in the city of Mexico and the road will be under Mexican jurisdiction.

SANTO DOMENGO MIDLAND.—Incorporated in New Jersey June 6, to build railways, etc., on the island of Santo Domingo; capital stock, $500,000, with $2,000 paid in; incorporators Dudley Farlin, James Cameron, A. L. Fowler and Caleb A. Burbank, of New York; Wm. M. Kennedy, of Albany, N. Y.; Chas. E. Wilson and Seward Davis, of Jersey City, N. J.

STREET AND ELECTRIC RAILWAYS.

EAST HARTFORD, CONN.—W. H. Olmstead is reported as surveying the route from Manchester to Rockville for the Hartford, Manchester & Rockville Tramway Co.

STAFFORD SPRINGS, CONN.—The Rockville, Stafford & Southbridge Electric R. R. Co. has been organized to build a road at once from this place to Staffordville. Pres., Wm. B. Ferguson, of Malden, Mass.; Treas., Chas. C. Davison, of Lewiston, Me.; Secy., R. S. Hicks, of Stafford Springs.

BUFFALO, N. Y.—The Buffalo, North Main St. & Tonawanda Ry. Co. has been incorporated to operate a road already built; capital stock, $75,000; directors, S. W. Petrie, J. H. Pardee, of Buffalo; H. H. Crowell, of Syracuse, and Howard C. Levis, of Schenectady.—The Buffalo Ry. Co. is reported about to extend its tracks on several streets. Gen. Man., H. H. Little.

LITTLE FALLS, N. Y.—The Little Falls St. Ry. Co. has been incorporated to build a road seven miles in length; capital stock, $75,000; directors, Wm. H. Tylee and T. C. Bates, of Worcester, Mass.; Frank H. Viele, John L. Miller, Chas. M. Hyde and C. L. B. Tylee, of Corning.

ROME, N. Y.—The City Street Ry. Co. has petitioned for permission to change the motive power of its road to electricity. Secy., W. P. Rayland.

SYRACUSE, N. Y.—It is reported that bids were to be opened June 12 by the Syracuse Street R. R. Co. for the extension of its road on certain streets, the work to be completed by Oct. 31. Ch. Engr., H. S. Newton.

TROY, N. Y.—We are informed that the construction of the Troy & New England Ry. was commenced June 10. Geo. T. Lane, E. F. Murray, Wm. Shaw, J. K. Averill and Supt. Smith of the Troy City Ry. are members of the executive committee of the syndicate that has agreed to build the first 10 miles of the road from Albia (city line) to Averill Park, the contracts for which have been awarded as follows: T. William Harris, of New York, for grading, bridge work, tracklaying, etc.; Westinghouse Electric & Mfg. Co., of Pittsburg, motors and generators for the power station; Burger & Rogers, of Troy, stringing trolley wires; Lackawanna Iron & Steel Co., of Scranton, Pa., steel rails. The contracts call for the completion of the work by Aug. 1, and cars are to be running by Aug. 15. Ch. Engr., Prof. Wm. G. Raymond; Treas., J. J. Tillinghast.

DUBLIN, PA.—We are informed that an electric railway is to be built from this place to Souderton, a distance of eight miles, at an estimated cost of $128,000.

ERIE, PA.—The Erie & Eastern St. Ry. Co. has been incorporated with a capital stock of $25,000; Pres., Henry L. Moon, of Erie.—The Erie, Reed Park & Lake Side St. Ry. Co. has been incorporated to build an electric railway; capital stock, $50,000, with $5,000 paid in; Pres., Chas. M. Reed, of Erie.

LOCK HAVEN, PA.—R. H. Irwin, Ch. Engr., writes us that surveys have been made, right of way obtained and capital secured for the Lock Haven Traction Co.'s electric road between Mill Hall and Salona, a distance of 2¾ miles. Belden & Seely, 121 Liberty St., New York, are the contractors.

NEWTON, PA.—We are informed that the Newton Trolley Co. has been granted right of way in Bristol.

NORTH EAST, PA.—The South Shore St. Ry. Co. has been incorporated to build an electric railway between this place and Erie, a distance of about 15 miles; capital stock, $100,000, with $10,000 paid in; Pres., L. J. Chase, of Buffalo, N. Y.; Frank McLaughlin, of this city, is interested.

PERKASIE, PA.—The People's Traction Co., of Philadelphia, is reported to have made a proposition that if the people above Doylestown would raise $6,000 per mile the company would furnish the balance of the capital for the construction of its electric road from Doylestown to this place and Quakertown, which means that the company will provide all capital except about $75,000.

WILKES BARRE, PA.—John Graham, Pres., writes us that the construction of the Wilkes Barre & East Side Ry. Co.'s electric road, three miles in length, is about completed. The road is leased to the Wilkes Barre & Wyoming Valley Traction Co. Ch. Engr., Allen Wright, of Wilkes Barre.

BALTIMORE, MD.—It is reported that those interested in the construction of the Baltimore & Washington Boulevard Electric Ry. have made a proposition for the purchase of the Short Line, operated by the Baltimore & Potomac R. R. Co., which is about four miles in length, and that it is proposed to equip it with electricity. James A. Gary, Pres. Short Line

WASHINGTON, D. C.—We are informed that bids are now being considered for the construction of the Washington & Great Falls Electric Ry. to Cabin John Bridge, estimated to cost $650,000. Pres., Stilson Hutchins; Treas., J. P. Clark; Ch. Engr., F. H. Stier, Hutchins Bldg.

GREENE, O.—It is reported that an electric railway company is being organized to build a road in Trumbull county to connect with an electric railway to Cleveland. A. A. Raymond, of Greene; G. W. Wilcox, of Mesopotamia; D. T. Snyder, of Bloomfield, and R. B. Barnes, of Gustavus, are interested.

NORWALK, O.—The council has granted S. E. Crawford and others a franchise for a railway between Norwalk and Fairfield.

XENIA, O.—The Springfield, Clifton, Cedarville & Jamestown Electric Ry. Co. has been incorporated with a capital stock of $100,000.

MARQUETTE, MICH.—C. R. Brown, of this city, and Fred Pomeroy, of Cleveland, have petitioned for a franchise for an electric railway.

PORT HURON, MICH.—Fick Bros., of Detroit, have been awarded the contract for building the Port Huron & Lexington Ry., work on which will begin at once, according to reports.

CHICAGO, ILL.—The Chicago City St. Ry. Co. has been incorporated, with a capital stock of $5,000,000, by A. G. Scott, A. J. Hawks and T. C. Kene.

PEORIA, ILL.—The Peoria & Fort Clark St. Ry. Co. has been incorporated, with a capital stock of $150,000, by William Curry, Chas. S. Williston and Emory D. Frazer.

SIOUX CITY, IA.—The Covington, South Sioux City & Dakota City St. Ry. Co. is to be reorganized, and it is proposed to extend the road to Crystal Lake Park.

BEATRICE, NEB.—The Beatrice Rapid Transit & Power Co.'s plant, which consists of an electric light plant, six miles of road, etc., and is appraised at $37,000, will be sold at auction July 3 by order of the United States circuit court. M. C. Steele, Receiver.

DALLAS, TEX.—The Dallas City St. Ry. Co. has been incorporated with a capital stock of $500,000 by Frank P. Clark, of Baltimore, Md.; Goldwin L. Blackwood, of Denison, Tex., and J. L. Sale, of Dallas.

PORTLAND, ORE.—The Barnes Heights & Cornell Mountain Ry. Co. is again considering the question of extending its electric road to Hillsboro, a distance of 10½ miles, and a branch line to Beaverton, a distance of 2½ miles, at an estimated cost of $10,000 a mile. Nelson, Nelson & Co., of Portland, are interested.

ELECTRIC LIGHT AND POWER.

CHICOPEE, MASS.—The committee has recommended that the council advertise for bids for erecting a 100 × 50-ft. one-story brick electric light station, at an estimated cost of $10,000 to $15,000.

TAUNTON, MASS.—The construction of a municipal electric light plant is being considered by the aldermen.

WINTHROP, MASS.—It is reported that a new electric light company is to be organized to light this place and Revere.

FRIENDSHIP, N. Y.—Efforts are being made to organize a company to light this place by electricity, according to reports.

GREEN ISLAND, N. Y.—Bids are asked until June 13 for the purchase of $20,000 of 3½% electric light bonds. Robt. B. Waters, Village Clk.

BLOOMSBURG, PA.—It is reported that a proposition will soon be voted on to issue $70,000 in bonds, $20,000 of which will be used to build an electric light plant.

PHILADELPHIA, PA.—Bids are asked until June 18 for furnishing and constructing a motor and dynamo for the electric disinfecting plant in the basement of the city hall. John J. McCay, Ch. Clk., Dept. Pub. Safety.

OAKEY, O.—The council is considering a resolution for the construction of an electric light plant, according to reports.

ROCK FALLS, ILL.—P. H. Davis writes us that the committee has been directed to advertise for bids for the erection of an electric light plant of 500 incandescent and 25 arc lights capacity.

KEOKUK, IA.—The citizens have voted to erect a municipal electric light plant, the power for which will be supplied by the Des Moines Rapids Power Co.

MADRID, IA.—J. P. Anderson has been granted a franchise for an electric light plant, work on which will begin at once.

WINDOM, MINN.—This city has voted to issue bonds for electric lights, water-works, etc.

SAN FRANCISCO, CAL.—The San Francisco Gas-light Co. has voted to build an electric light plant at Fifth and Tehama Sts., at an estimated cost of $2,000,000, according to reports. Pres., Joseph B. Crockett.

MONTREAL, QUE.—Bids are asked until June 20 for the masonry and excavation for the head and tail races for the Lachine Rapids Hydraulic & Land Co.'s dam. Engrs., T. Pringle & Son, and W. McLea Walbank; Secy., A. Pringle.

NEW COMPANIES.—Milwaukee Electric Mfg. Co., Milwaukee, Wis.; $8,000; John E. McKivitt, Mathias Weisser, Joseph C. Schmitt, Henry W. Newton.

Penn Electric Light, Heat & Power Co., Reading, Pa.; $100,000.

Hammond Lighting Co., Chicago, Ill.; William P. Engel, Chas. F. Griffin, Marian E. Barnhart.

Mfg.'s Bldg. & Power Co., Indianapolis, Ind.; $100,000; Julius D. Pratt, Addison Bybee, Nathan Morris.

Trumansburg Electric Lighting Co., Trumansburg, N. Y.; $10,000; C. C. Sears, A. S. Mosher, James H. Smith, O. G. Noble.

San Jose Lighting Co., San Jose, Cal.; $250,000, with $1,250 paid in; Chas. F. Wilcox, Joseph R. Patton, Wm. H. Summer, Reinhardt L. Stock.

BRIDGES.

PITTSFIELD, ME.—A town meeting is to be held June 14 to vote on the question of reconstructing the so-called short bridge.

BOSTON, MASS.—The Boston & Maine R. R. Co. is reported as about to build an iron or steel viaduct at Charlestown, as noted under Railways.

BOSTON, MASS.—Plans have been prepared for a new plate girder bridge, to be completed by Sept. 1, over the New York & New England tracks at Gold St., South Boston.

CHESTER, MASS.—The following bids were received for constructing a bridge over Westfield River:

Plank Floor Bridge.			
Massillon Bridge Co.....	2 spans	60 ft.	$8,700
New England Engineering Co.	2 "	60 "	8,400
Groton Bridge Co.	2 "	80 "	8,390
Berlin Iron Bridge Co.	2 "	85 "	8,700
R. F. Hawkins Iron Works...	2 "	85 " truss	7,989
		Plate girder	6,175
Wrought Iron Bridge Co.....	1 span	178 ft.*	9,200
Ballast Floor Bridge.			
New England Engineering Co..	2 spans	60 "	9,300
Berlin Iron Bridge Co.	2 "	85 "	9,850
R. F. Hawkins Iron Works...	2 "	85 " truss	9,185
		Plate girder	9,375
Stone Arches.			
**Melan Arch Construction Co.	2 "	55 ft.	9,410
3 spans, 50 ft., or	2 "	75 "	11,950
F. L. Kittridge, all stone....	3 "	33½ ft.	10,000
(Not including railing.)			

* High truss. ** Melan arch with stone finish.

SPRINGFIELD, MASS.—It is reported that a new iron bridge is to be built over Muddy Brook on the road to Suffield.

WOONSOCKET, R. I.—The commission has voted to rebuild the west wing wall of the new bridge.

NEW HAVEN, CONN.—It has been decided to rebuild the bridge over the West River at Kimberly Ave., the cost to be equally divided between this city and Orange.

NEW LONDON, CONN.—A bridge is to be built across the Alewife Cove jointly by this city and the town of Jordan.

BUFFALO, N. Y.—The following bids were received by the New York Central R. R. Co. for the construction of an iron superstructure over the railway tracks at Michigan St., as provided for in the city's contract for abolishing grade crossings at this point; engineer's estimate, $98,000.

Rochester Bridge & Iron Works, Rochester....	$83,016
King Bridge Co., Cleveland.....	83,099
Shiffler Bridge Co., Pittsburg.....	89,345
Elmira Bridge Co., Elmira, N. Y.....	82,800
Hilton Bridge Co., Albany.....	84,000
Buffalo Bridge & Iron Works.....	88,081
Union Bridge Co., Athens, Pa.....	82,800
Pennsylvania Steel Co., Steelton, Pa.....	83,750

It is stated that the railway company will contract with the Union Bridge Co. for its share of the work. The city's share will cost $13,267.

ROME, N. Y.—The governor has signed bills authorizing the city to spend $3,500 for a draw or swing bridge over the Black River Canal at Garden St., and appropriating $7,000 for a new bridge over the canal at Thames St.

SYRACUSE, N. Y.—Bids are asked until June 17 for constructing a stone arch bridge over Harbor Brook. H. F. Stephens, Cy. Clk.

ELIZABETH, N. J.—Press reports state that the Central R. R. of New Jersey has made arrangements to begin on July 1 the work of depressing the streets in Elizabeth under its main line. There are five streets to be lowered, and girder bridges will be used for the railway to run over at these points—viz., Madison and Jefferson Aves., and Catherine, Spring and Reid Sts. The work is to be pushed rapidly forward, so as to be completed before winter sets in.

PATERSON, N. J.—The freeholders are again discussing the question of constructing a bridge at 10th St. and Preakness Ave.

FREEMANSBURG, PA.—Bids are asked until June 21 for repairing a highway bridge over the Lehigh River at this place, as stated in our advertising columns. Engr., J. M. Porter; M. H. Shall, Clk. County Comrs., both of Easton, Pa.

PHILADELPHIA, PA.—The board of surveys has approved the detailed plans for the two bridges which are to carry 33d St. over the Philadelphia & Reading and Connecting railways at Fairmount Park, between Columbia and Girard Aves. The bridges will be 60 ft. wide each, and will cost about $200,000.

SCRANTON, PA.—Bids are asked until June 20 for constructing the substructure for a bridge over Leggett's Creek at Welles St. W. T. Lavelle, Cy. Clk.

WILLIAMSPORT, PA.—Bids are asked until June 15 for constructing a wooden or iron bridge over Grafius Run on Rural Ave., the bridge to be 60 ft. wide and have a clear span of 15 ft. J. J. Galbraith, Cy. Clk.

WHEELING, W. VA.—The committee has been authorized to construct two steel bridges on the National road, one at Barney Crow's, and the other at Sunday's.——The Canton Bridge Co. has been awarded the contract for constructing a 190-ft. iron bridge over Big Wheeling Creek, on the Marshall county line, at $2,152, and that for a bridge on Short Creek, in Richland district, at $1,490.

PALM BEACH, FLA.—It is reported that Henry M. Flagler contemplates building a drawbridge across the lake at this place, and also an iron pier into the ocean.

CINCINNATI, O.—Bids are asked until June 22 for building an iron Pratt truss bridge over Schnapps Creek, on Hanley road, Colerain township. Geo. C. Zimmerman, Clk. Bd. Hamilton County Comrs.——The board of administration has passed a resolution authorizing the city auditor to issue $50,000 in bonds for the construction of a bridge over Florence Ave., between Gilbert Ave. and Kenton St.

COLUMBUS, O.—Bids are asked until July 5 for the construction of a 28-ft. sandstone arch culvert. The work includes 144 perch of sandstone masonry, 240 cu. yds. of dry excavation, and 1,150 cu. yds. of filling. Wm. H. Halliday, County Audr.

MANSFIELD, O.—Bids are asked until July 6 for constructing a brick arch over Ritters Run. F. M. Remy, Cy. Clk.

EATON RAPIDS, MICH.—This town has voted $1,200 for a new bridge over the Grand River at Peterville.

KALAMAZOO, MICH.—The council has voted to build a bridge over the Kalamazoo River at Mill St., at an estimated cost of $2,000.

LANSING, MICH.—An election will be held June 18 to vote on the question of issuing $25,000 in 4½ bonds for completing the bridge across the Grand River at Michigan Ave.

GREEN BAY, MICH.—The question of building a new steel bridge over the Fox River at Walnut St., at an estimated cost of $30,000 or $40,000, is being considered.

MOLINE, ILL.—A press report states that the secretary of war has directed the city to raise the bridge over Rock River 27½ ft., or to put in a draw span, the work to be completed in six months.

ST. JOSEPH, MO.—Chas. W. Campbell, Cy. Engr., writes us that preliminary plans and estimates have been prepared for some time for a viaduct from Sixth to Seventh St. The matter is not at present being considered, and there seems to be little prospect of the work being done this season.

MONTREAL, QUE.—The South Shore Suburban Ry. Co. has petitioned for a charter. Besides a railway, the company proposes to build a bridge over the St. Lawrence River from St. Lambert or Longueuil to St. Helen Island, and from there to Montreal Harbor. Incorporators, A. W. Ogilvie, Louis Tourville, Thomas Pringle, Joseph S. Bousquet, of Montreal, and T. E. Normand, of Three Rivers.

CASSELMAN, ONT.—It is reported that bids will soon be asked for rebuilding the bridge over the Nation River at this place. W. Shanley is preparing the plans.

BUILDINGS.

WORCESTER, MASS.—The council has passed an ordinance appropriating $5,000 for plans for a new city hall on the common, to cost not to exceed $300,000, and the mayor has been authorized to invite the local architects to submit plans, on the condition that the successful architect should have the job of superintending the construction of the building. The second best plan will receive $2,000; the third, $1,500; the fourth, $1,000, and the fifth, $500.

NEW HAVEN, CONN.—Geo. M. Grant has been awarded the contract for erecting the new roundhouse, 288 ft. in diameter, for the New York, New Haven & Hartford R. R. Co., at the Cedars, at about $45,000.

BROOKLYN, N. Y.—Bids are asked until June 24 for constructing a fire engine house on 86th St. F. W. Wurster, Comr. Fire Dept.

BROOKLYN, N. Y.—Bids are asked by the committee until June 17 for enlarging, heating and ventilating the county court house. Daniel Ryan, Supt. Construction.

BUFFALO, N. Y.—A. E. Koehn, Arch., has prepared plans for a five-story brick apartment house, with steel framework, to be built for Rung Bros., near the northwest corner of Main St. and Glenwood Ave. It will cost about $50,000.

NEW YORK, N. Y.—Bids are asked by the board of education until June 17, 19, 20, 22 and 24 for making alterations, enlarging the heating and ventilating apparatus, etc., in 13 school buildings.

NEW YORK, N. Y.—Plans have been filed by Hugh Lamb, of East Orange, N. J., for a 15-story brick office building at Nassau and Liberty Sts., to cost $185,000; by Five Points House of Industry, 155 Worth St., for an eight-story brick chapel and mission house on Worth St., near Center St., to cost $110,000.——Plans have been prepared by W. Wheeler Smith for a five-story brick addition, 175 x 36 ft., to Roosevelt Hospital on 58th and 59th Sts., estimated to cost $150,000.

PITTSBURG, PA.—Henderson, Johnson & Co. have been granted a permit to build a four-story brick, stone and steel elevator on Carson St., to cost $28,000.

WILKES BARRE, PA.—Bids are asked until June 30 for building a city jail. Arch., Thomas Podmore; Morgan B. Williams, Chn. Pub. Property Com.——The county commissioners have rejected the bids for the construction of a stone court house, estimated to cost about $800,000. Arch., E. E. Myers, Detroit, Mich.; James M. Morris, Ch. Clk., County Comrs.

CHARLESTON, S. C.—Bids are asked until June 25 for putting a steam heating and ventilating system and power boiler in the court house and post office building in this city. Address Wm. M. Aiken, Supervising Arch., Washington, D. C.

WASHINGTON, D. C.—The followings bids were received May 20 by Col. J. M. Wilson for a steel frame for fireproof building at the government printing office:

Fred J. Myers Mfg. Co., Hamilton, O.....	$26,470
Milliken Bros., 39 Cortland St., New York.....	26,438
New Jersey Steel & Iron Co., Trenton, N. J..	28,282
Phoenix Iron Co., Philadelphia (accepted).....	23,800
Thos. Marshall, Pittsburg, Pa.....	26,757
The Structural Iron Erecting Co., Baltimore....	24,949
O. A. Schneider's Sons, Washington.....	25,550
B. N. Gray & Co., Washington.....	28,163
Youngstown Bridge Co., Youngstown, O.....	26,482

WHEELING, W. VA.—Bids are asked until June 15 for erecting an office and bank building for the Exchange Bank. John Waterhouse, Chn.

LAFAYETTE, IND.—Bids are asked until July 8 for buildings for the Indiana State Soldiers' Home, to cost about $60,000. Arch., J. F. Alexander; Engr., W. K. Eldridge.

DETROIT, MICH.—Bids are asked until June 26 for the metal work and construction of the Round Island light station, Straits of Mackinac. Maj. N. B. Adams, Lighthouse District Engr.

CHICAGO, ILL.—It is reported that Henry Ives Cobb, of this city, is preparing plans for the new post office building, estimated to cost $4,000,000.——Charles Raestner & Co. have awarded the contract for the erection of a six-story factory at 241 to 247 South Jefferson St., which will consist of two buildings, to Thomas Clark & Son, at about $160,000.

CHEROKEE, IA.—It is reported that arrangements are being made by the committee for the construction of a state insane asylum in this city, estimated to cost about $800,000.

WATER-WORKS.

BANGOR, ME.—The water board is receiving estimates on the cost of 100 meters. The purchase has not been definitely decided upon.

CENTER HARBOR, N. H.—The residents of this place are reported as agitating the question of works.

BURLINGTON, VT.—It is reported that a new system of water-works and other improvements are to be made at Queen City Park.

LYNDON CENTER, VT.—The residents of this village have decided to have the Lyndonville works, now being constructed, extended to this village and will contract for six hydrants, according to reports.

ACTON, MASS.—An engineer is reported to have been engaged to make surveys and estimates for work, which will probably include a reservoir on a hill about equally distant from the villages of Acton, West Acton and South Acton.

ADAMS, MASS.—A successful test well, 80 ft. deep, has been sunk, and it is reported that a number of wells will be put down.

BELMONT, MASS.—Bids are asked until June 14 for hauling and laying 1¼ miles of water pipe. Engr., E. A. W. Hammatt, 29 Pemberton Square, Boston. H. S. Harris, Chn. Comrs.

BOSTON, MASS.—A contract for excavating section B at basin No. 5, Southboro, has been awarded to Moulton & O'Mahoney, of Boston, at $68,788. At a previous opening of bids the contract was awarded to Newell & Snowling, at $86,851, the bids being published in our issue of May 2, but the mayor refused to sign the contract.

LANCASTER, MASS.—Joshua Thissell & Son, of Clinton, have prepared plans for a water supply for the state industrial school for girls at this place, for which $7,500 was appropriated by the legislature.

LENOX, MASS.—The contract for enlarging the Yokum storage reservoir has been awarded to John J. Marsh, of North Adams.

NEW BEDFORD, MASS.—Bids are asked until June 26 for the construction of a reservoir, etc., as described in our advertising columns. Engrs., Geo. S. Rice & Geo. E. Evans, Boston; Supt., R. C. P. Coggeshall.

PITTSFIELD, MASS.—It is reported probable that the Onota Water Co., recently organized to supply a section of this place, will construct its works this season.

QUINCY, MASS.—By a vote of 12 to 10 the city council has instructed the mayor to request that this city be included in the metropolitan water supply district.——It is reported that an investigation recently made estimated the cost of proposed extensions and improvements at $610,000.

BRISTOL, R. I.—The town council is considering a proposition of a company that wishes to construct works to cost $50,000, according to reports.

GREENWICH, CONN.—John Dayton, Supt., Greenwich Water Co., writes us that the company is now laying about 20,000 ft. of 16-in. pipe, John C. Merritt, of Portchester, N. Y., being the contractor, and that nothing has yet been done in regard to the proposed extension to Cos Cob, noted in our issue of May 23.

AFTON, N. Y.—The residents of this village have voted, 52 to 37, in favor of works.

AFTON, N. Y.—We are informed by the water commissioners that the plans recently prepared call for a gravity supply, with 4½ miles of 8 to 4-in. pipe and 50 hydrants; estimated cost, $15,000; population, 850.

BINGHAMTON, N. Y.—John Anderson, Secy., writes us that S. M. Gray, of Providence, R. I., is preparing plans for the proposed new reservoir, for which the city was recently authorized to issue bonds.

BUFFALO, N. Y.—Bids are asked until June 21 for the purchase of 100 tons of pig lead; R. G. Parsons, Secy. Dept. Pub. Wks.——The contract for rebuilding pumping engines Nos. 1, 2 and 3, and increasing their capacity, has been awarded to Henry R. Worthington, at $97,300.——We are informed that the following bids were received June 4 for building a new tunnel 8 x 8 ft. and 1,012 ft. long, to run parallel with the old tunnel, from the pumping station to the inlet pier: Anderson, Barr & Usher, New York, $69,450; Huntington & McNaughton, Buffalo, $74,900; A. C. Douglass, Niagara Falls, $74,600.

CAPE VINCENT, N. Y.—The water commissioners have voted in favor of constructing works to cost $25,000.

CHERRY VALLEY, N. Y.—James Young, Village Clk., writes us that it is not expected that works will be put in this year.

CORNWALL-ON-THE-HUDSON, N. Y.—Bids are asked until July 5 for constructing works, as stated in our advertising columns. Engr., Alexander Potter, New York.

KINGSTON, N. Y.—The water commissioners will receive plans or suggestions until June 15 for a water supply. John W. Searing, Secy.

LAURENS, N. Y.—The village has voted, 28 to 18, to issue $8,000 in bonds for works.

MERRICK, N. Y.—The Merrick Water Co. has been incorporated with a capital stock of $5,000, by Hermann H. Cammann, Chas. N. Kent, P. R. Jennings and E. E. Cammann, of Merrick; Wm. D. Morgan, of New York, and others.

MIDDLETON, N. Y.—A water board has voted to make extensions estimated to cost about $8,000.

MIDDLEVILLE, N. Y.—At a public meeting last week the citizens decided in favor of holding an election to vote on the construction of works, estimated to cost $2,000.

NEW YORK, N. Y.—The New York Suburban Water Co. has been incorporated with a capital stock of $1,500,000, and has acquired the property and franchises of the New York City Suburban Water Co. Newman Erb, of New York, and Charles Bard, of Norwich, Conn., who recently purchased this property, are among the incorporators of the new company.

RED HOOK, N. Y.—Frank E. Burnett, Village Clk., writes us that specifications will be ready for bidders in about three weeks; population, 900. Engr., E. D. Smalley, Syracuse.

ROCKVILLE CENTER, N. Y.—Plans for the new works are about completed. The plans include a stand-pipe 100 ft. high and about five miles of mains, according to reports.

SANDY HILL, N. Y.—The Spring Brook Water Co. is reported about to construct a new 1,000,000-gallon reservoir, purchase another 100-HP. boiler and lay 1½ miles of extensions.

SAUGERTIES, N. Y.—J. Dederick, Clk., writes us that the Consumers' Water Co. has taken no further steps since organizing, and that the matter is now resting.

SYRACUSE, N. Y.—The contracts for laying 15 4-10 miles of mains in the southeast section of the city, and 13 4-10 miles in the southwest section have been awarded to P. J. Brumelkamp & Thos Lane and John Dunfee, respectively. The total bids were given last week. W. R. Hill, Ch. Engr., has been authorized to advertise for bids for laying 20-in. mains across the creek.

SYRACUSE, N. Y.—The following bids were received June 7 for extending the mains, as advertised in Engineering News; contracts will probably be awarded to lowest bidders:

	Northwest section.	Northeast section.
P. J. Brumelkamp, Thomas Lane and M. B. Birdseye, Syracuse	$23,263	$27,925
Abbott-Gamble Contr'g Co., St. Louis	23,449	28,044
Lewis B. Moore, Syracuse	23,567	26,019
Clinton Beckwith, Herkimer	24,376	27,682
John Kelley, Syracuse	24,820	27,843
W. D. Dodge & J. MacGregor, Buffalo	25,416	29,556
John Dunfee, Syracuse	25,697	29,169
Thomas Marnell, Syracuse	25,710	.....
G. D. Grannis, Syracuse	25,174	30,875
J. Kiney & M. Dillon, Syracuse	28,090	31,608
W. T. O'Connor & Co., Syracuse	28,756	.....
P. H. Harrison & Sons, Newark, N. J.	.....	26,841
A. F. Nims, Elkhart, Ind.	.....	20,092

WARSAW, N. Y.—At an election June 3 the taxpayers voted in favor of establishing municipal works, at an estimated cost of $40,000.

WEST TROY, N. Y.—The contracts for constructing works at the Watervliet arsenal have been awarded as follows: Water tower, etc., McGowan & Bolan, $5,592; filters, etc., Wm. H. Barnes, $5,836; iron tank, T. S. Sutherland, $1,550. The total bids were published last week.

WHITESBORO, N. Y.—The question of works is again being agitated. It is reported that the New Hartford Water-Works Co. is considering the question of extending its service to this place.

WILLARD, N. Y.—Bids are asked for furnishing and placing 800 ft. of 16-in. cast iron flanged pipe on the present suction pipe. T. H. Kellogg, Supt., Willard State Hospital.

BEAVER MEADOWS, N. J.—The Citizens' Water Co. has been organized, with a capital stock of $4,000, of which $400 is paid in; Pres., James Rowe; Secy., J. M. Stauffer. It is stated that Fred Bertolette, lawyer, of Mauch Chunk, will apply for the charter.

CAMDEN, N. J.—The water committee of the council and members of the board of trade and commercial club have practically agreed upon a supply from artesian wells as the best for this city.

JERSEY CITY, N. J.—Bids are asked until June 17 for furnishing and laying 3,700 ft. of 12-in. pipe, with gates, etc. Geo. T. Bouton, Clk. Comrs.

NUTLEY, N. J.—The Franklin township committee has voted to request the Nutley Water Co. for a written option on its plant, at $45,000.

WILDWOOD, N. J.—The Wildwood Water Co. was incorporated June 7, with a capital stock of $100,000, by J. S. Keen, H. Baird Hodge, Philadelphia; Geo. Reynolds, Ernest Watts, Burlington, N. J.; L. R. Baker, P. P. Baker, of Wildwood, and others.

ALLEGHENY, PA.—The $600,000 of 4% water extension bonds have been sold to the German National Bank of Allegheny for $640,272.

BEDFORD, PA.—The council has voted in favor of issuing $26,000 in bonds for increasing the water supply. The question will have to be submitted to a vote of the citizens.

McKEESPORT, PA.—It is reported that the council has accepted a proposition of the Wagner Water Supply Co. to sink test wells for the purpose of securing a better water supply.

MONACA, PA.—At a special election May 29 the citizens voted, 206 to 19, to issue $30,000 in bonds for works.

MYERSTOWN, PA.—The Myerstown Water Co. was incorporated June 8, with a capital stock of $20,000, of which $2,000 is paid in; Treas., A. S. Harkness, Quarryville, Pa.

NEW CASTLE, PA.—It is reported that the construction of a 2,000,000-gallon reservoir has been commenced. Engr., E. Woolford.

PHILADELPHIA, PA.—Maj. Chas. W. Raymond, U. S. Engineer Office, and Rudolph Hering, New York, have been engaged to act with John C. Trautwine, Chief of the Water Bureau, as a board of inspectors to examine the Queen Lane reservoir.

PLYMOUTH, PA.—The water company is reported as about to construct a reservoir at Larksville.

READING, PA.—The water board has decided to use meters more generally.

HYATTSVILLE, MD.—It is reported that an engineer is making surveys for water supply.

WASHINGTON, D. C.—Bids are asked by the district commissioners until June 20 for a supply of cast iron water pipe, as stated in our advertising columns last week.—It is reported that work will be resumed on the Fort Reno reservoir immediately after the new appropriation is available.

CHARLOTTE, N. C.—It is reported that the town of Dilworth will construct works.

ROCKY MOUNT, N. C.—It is stated that Thorp & Ricks are about to award contracts for a water supply, which will probably include four wells, a windmill, elevated tank, etc.

HIGH SPRINGS, FLA.—There is talk of sinking an artesian well at this place, according to reports.

ST. AUGUSTINE, FLA.—The St. Augustine Improvement Co. is reported as wanting estimates on works for this city; population, 6,000.

DEMOPOLIS, ALA.—Bids will be asked within a few days for the construction of works, to cost $17,000 or $18,000. Gesner Williams, Mayor, writes us that the supply will be from artesian wells; population, 2,500. J. G. Chisholm, Cy. Clk.

HOPKINSVILLE, KY.—Surveys are being made for a water supply at the insane asylum.

KUTTAWA, KY.—It is reported that works and an electric light plant will be put in.

BOWLING GREEN, O.—A press report states that the wells from which the water supply is secured are failing, and that a sufficient supply cannot now be secured even with deep well pumps.

CAMBRIDGE, O.—At an election June 3 the citizens voted to issue $60,000 in bonds for works. The plans include 53,000 ft. of 14 to 4-in. mains, a stand-pipe and two duplex pumping engines. O. M. Hoge, Cy. Engr.

CINCINNATI, O.—Bids are asked until July 9 for the construction of steel water tank 40 ft. in diameter and 70 ft. high at Mount Auburn. A. P. Butterfield, Clk. Bd. of Administration.

KENTON, O.—The city has sold $10,000 of the water improvement bonds to the Kenton National Bank for $10,331.

MONTPELIER, O.—The city received 12 bids for the purchase of $31,000 in bonds, recently voted for the construction of works and an electric light plant, the highest being that of Spitzer & Co., of Toledo, at $34,261.

PERRYSVILLE, O.—Bids are asked until June 25 for the construction of works, as stated in our advertising columns. A. W. Budd, Chn. Trustees.

PORT CLINTON, O.—Bids are asked until July 2 for the purchase of $7,000 additional water bonds. J. H. Faus, Village Clk.

TOLEDO, O.—The water board has voted in favor of about two miles of additional extensions. The department laid about 4½ miles of pipe during May and put in 258 taps for immediate use.

EVANSVILLE, IND.—The citizens' sanitary committee has voted in favor of extending the intake pipe and making other improvements, estimated to cost $7,500.

FOWLER, IND.—The "Era" states that the construction of works in this town is an absolute necessity.

GARRETT, IND.—E. P. Fitzgerald writes us that at a special meeting of the council June 10 it was expected that steps would be taken towards securing plans for works; population, 3,500.

MARION, IND.—The water board has issued a proclamation requesting that no water be wasted. It is investigating the question of an additional and better supply. H. F. Clunk, Clk.

BATTLE CREEK, MICH.—W. H. Brigden, Supt., writes us that the city will probably lay four miles of 12 to 6-in. pipe, with 40 hydrants and 30 valves, and will put in 200 meters, the work to cost over $25,000. The materials will probably be purchased in July and the work done by day labor.

IONIA, MICH.—The council is considering the purchase of 50 meters and the taking of other steps to prevent a waste of water.

MANISTIQUE, MICH.—George L. Wells, of the Michigan Pipe Co., Bay City, is said to be making surveys for works at this place, and it is reported probable that an election will soon be held to vote on an issue of $50,000 in bonds for the construction.

CAMBRIDGE, ILL.—At a recent mass meeting called by the city council, it was voted to secure plans for adequate fire protection. It is proposed to sink an artesian well and to construct works, to cost about $25,000. Engr., W. A. Darling, Rock Island, Ill.

CHICAGO, ILL.—A site has been purchased for a West Side pumping station, at West 46th St. and Jackson Boulevard.

CHICAGO, ILL.—Judge Horton of the circuit court has decided that the contract awarded to the Holly Mfg. Co. some time ago for pumping engines to cost $275,000 is invalid.

GALESBURG, ILL.—The committee has recommended that additional wells, probably 40, be sunk, and a location for the wells is now being secured.

EARLVILLE, ILL.—Bids are asked until June 24, according to reports, for the construction of works. Engr., N. E. Stucker, Ottawa, Ill.; D. M. Vosburg, Cy. Clk.

FORREST, ILL.—At an election June 3 the citizens voted to construct works to cost about $6,000, according to reports.

SPRINGFIELD, ILL.—The mayor and water committee are reported to have decided to extend the infiltration gallery 400 to 600 ft., lay about two miles of 10 to 6-in. pipe, etc.

ELKHORN, WIS.—Jay F. Lyon, Village Clk., writes us that at an election June 4 the village voted to issue $18,000 in bonds for works, for which plans and specifications will be prepared as soon as possible. A well 1,050 ft. deep has already been sunk.

LA CROSSE, WIS.—The city has sold $75,000 of 5% water bonds. The commissioners of the sinking fund took $25,000 at par, and Trowbridge & Co., of Chicago, paid $55,577 for the balance.

MARINETTE, WIS.—Press reports state that an artesian well may be sunk for a pure water supply.

MILWAUKEE, WIS.—There is talk of constructing reservoirs at the county buildings at Wauwatosa.

JUNEAU, WIS.—The city clerk writes us that the following bids were received June 4 for the construction of works:

Fairbanks, Morse & Co., Chicago (awd'd contract)	$7,830
Geo. Cadogan Morgan, Chicago	8,033
Ed. Steigerwald, Milwaukee, Wis.	9,560
Jos. H. Fife, Oshkosh, Wis.	9,170
D. Ahren, Fond du Lac, Wis.	9,190
W. H. Wheeler & Co., Beloit, Wis.	9,230
U. S. Wind Engine & Pump Co., Batavia, Ill.	8,500
John J. Crilley & Son, Milwaukee, Wis.	9,719

ALTA, IA.—Bids are asked until June 20 for the construction of works. Engr., Chas. F. Loweth, St. Paul, Minn.; C. E. Cameron, Chn. Com.

BOONE, IA.—The question of extending and improving the works is being agitated, and a press report states that $14,500 in bonds has been voted for this purpose.

MADRID, IA.—The citizens are reported to have voted to grant a franchise for works to J. P. A. Anderson and John P. Anderson.

OTTUMWA, IA.—Receiver Brownell, of the water company, has been authorized to purchase a new filter plant from the O. H. Jewell Filter Co., which, it is stated, will cost about $20,000.

WILLIAMSBRIDGE, IA.—The council has contracted with Fairbanks, Morse & Co. for a steam pumping plant to pump water from a deep well.

CHATFIELD, MINN.—The citizens have voted to issue $3,000 in bonds for works.

SHERBURNE, MINN.—Bids are asked until June 20 for the purchase of $10,000 in water bonds. H. H. McGovern, Village Recdr.

STEWARTVILLE, MINN.—Bids are asked until June 26 for the construction of works. B. W. Moore, Village Recdr.

WINDOM, MINN.—The citizens are reported to have voted to issue bonds for works.

MILES, MONT.—It is reported that $20,000 in water and electric light bonds will be issued.

AUSTIN, TEX.—A press report states that an election will be held June 24 to vote on the question of issuing $200,000 in water and light bonds, the former ordinance authorizing an issue of $125,000 in bonds having been repealed.

DALLAS, TEX.—Bids are asked until June 18 for the purchase of the East Dallas stand-pipe, 14 ft. in diameter and 100 ft. high. T. L. Lawhon, Cy. Secy.

FORT WORTH, TEX.—Estimates are being secured by the superintendent for 127 tons of 6-in. and 137 tons of 8-in. pipe. It is stated that this can be purchased from the Huntsville penitentiary at $21.60 a ton.

GOLIAD, TEX.—Bids are asked until June 25 for the construction of works. J. H. Ewell, Secy. Goliad W. W. Co.

RICHMOND, TEX.—R. Lee Eckman, Secy. Commercial Club, writes us that no contracts have yet been awarded for the proposed works. It is thought that it would be a good investment for some company to construct the plant; population, 1,250.

SAN FRANCISCO, CAL.—Bids are asked until June 28 for duplicating the pumps and machinery with surface condenser at the new pumping works at the Presidio. A. S. Kimball, Deputy Q. M. Gen., Ch. Q. M.

ORANGEVILLE, ONT.—Willis Chipman, of Toronto, has been engaged as engineer of proposed works estimated to cost $45,000. The works will probably be built this year.

IRRIGATION.

HELENA, MONT.—It is reported that R. J. Perry, resident land inspector for the Northern Pacific R.R. Co., assisted by J. Fletcher and H. F. Phillips, has been making surveys for an irrigation ditch on the north side of the Yellowstone River, opposite Forsyth.

NEW COMPANIES.—Alfalfa Land & Irrigation Co.; Council Bluffs, Neb.; $5,000,000; C. O. Knowles, P. G. Noel, Wm. C. Campbell.

Summit Irrigation & Water Power Co., Klamath Falls, Ore.; $3,000; Henry D. Stout, C. L. Parrish, Benjamin Stout.

Umatilla Irrigation, Land & Nursery Co., Pendleton, Ore.; $20,000; F. G. Hull, E. B. Cox, Jonathan Talbert, J. F. Campbell.

Fremont Canal & Power Co., Fremont, Neb.; $1,500,000; incorporated for irrigation purposes; Wilson Reynolds, E. H. Barnard, Robert Bridge and L. D. Richards.

Abby Land & Improvement Co., San Francisco, Cal.; $270,000, with $2,200 paid in; to construct irrigation canals, reservoirs, etc.; Geo. L. Center, Wm. H. Crino, Edgar M. Wilson, Chas. J. King, San Francisco.

SEWERAGE.

DOVER, N. H.—Ernest W. Bowditch, of Boston, has been engaged to prepare plans for a system, as noted in our issue of May 23, but Fred E. Quimby, Cy. Clk., is quoted as stating that the immediate construction of a general sewer system is not contemplated, but that the idea is to secure a plan for a general system, so that future extensions and improvements may be constructed with a view to being a part ultimately of a general system.

FITCHBURG, MASS.—David A. Hartwell, Cy. Engr., writes us that nothing has yet been done about appropriating money for surveys and estimates for the proposed main sewer, and that it is doubtful if anything will be done this year, or at least before fall.

LAWRENCE, MASS.—Arthur D. Marble, Cy. Engr., writes us that $45,000 has been appropriated and plans have been commenced for the first section of the system in South Lawrence to abate the Shanty Pond nuisance.

MEDFORD, MASS.—T. Howard Barnes, Cy. Engr., writes us that contracts have been awarded as follows: R. Fahey, Somerville, $9,436; A. W. Bryne, W. Medford, $18,294; Lindsey & Cudmore, Somerville, $9,080. Some of the itemized bids will be published in a later issue.

AVON, N. Y.—An election will be held June 17 to vote on the question of constructing a system, estimated to cost from $10,000 to $12,000.

BATAVIA, N. Y.—J. W. Homes, Engr., has prepared plans for a system. E. A. Washburn, Secy. Comrs.

BINGHAMTON, N. Y.—Bids are asked until June 24 for constructing sewers in three streets. Lewis Sey-

mour, Cy. Clk.—It is proposed to construct about 2,500 ft. of 15 to 8-in. pipe sewers in two streets, at an estimated cost of $2,000.

BROOKLYN, N. Y.—The following bids were received June 7 for constructing cement pipe sewers: Subdivision 15, James F. Gillen, $27,477; Bogert & Farrell, $35,817. Sub-division 16, Bogert & Farrell, $7,699; James Jennings, $7,177; Edward Gorman, $7,208.

BUFFALO, N. Y.—Bids are asked until June 25 for constructing 12-in. pipe sewers in three streets. R. G. Parsons, Secy. Dept. Pub. Wks.

DUNKIRK, N. Y.—It is reported that the council has voted to advertise for bids for constructing sewers and for paving and macadamizing two streets.

ITHACA, N. Y.—Bids are asked until June 22 for constructing about 10,450 ft. of 14-in. wooden and iron pipe outfall sewers, and about 17,675 ft. of 26 to 10-in. pipe sewers, as stated in our advertising columns. Roger B. Williams, Chn. Comrs.; Henry N. Ogden, Ch. Engr.

NEWBURG, N. Y.—The city engineer has recommended the construction of a sewer in Third St., to relieve the grand trunk sewer.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2,622 Third Ave., until June 20 for constructing a sewer in Sherman Ave.

NORTH ELBA, N. Y.—Bids are asked until June 21 for constructing a sewer at Lake Placid. Geo. G. White, Supervisor.

ROCHESTER, N. Y.—Bids are asked until June 21 for constructing pipe sewers in three streets, and cement sidewalks in two streets. T. J. Neville, Clk.

ROME, N. Y.—The construction of a system is being agitated by the "Sentinel."

SYRACUSE, N. Y.—Bids are asked until June 17 for 36 to 20-in. brick sewers in two streets. H. F. Stephens, Cy. Clk.—It is proposed to construct 18 and 12-in. pipe sewers in two streets at an estimated cost of $3,437.

CAMDEN, N. J.—The street committee proposes to build sewers in nine streets and to pave portions of certain streets, at an estimated cost of about $200,000.

JERSEY CITY, N. J.—Bids are asked until June 17 for constructing 1,155 ft. of 15-in. pipe sewers, the work including 600 cu. yds. of rock excavation, etc. John C. Kaiser, Chn. Com.

MORRISTOWN, N. J.—John R. Brinley, Town Surv., writes us that nothing has yet been done in regard to the proposed system. The Morristown Improvement Society is agitating the question, but a vote of the people has first to be obtained before anything definite can be accomplished.

BRIDGEPORT, PA.—The council has voted to construct a sewer, with an outlet into the Schuylkill Navigation Co.'s canal.

CARBONDALE, PA.—It is proposed to extend the system 7,000 ft., at an estimated cost of $10,500.

CHARLEROI, PA.—Bids are asked until June 15 for constructing pipe sewers in three streets. W. L. Echer, Borough Engr.; C. P. Speers, Burgess.

MONTROSE, PA.—The construction of a system is being considered.

PITTSBURG, PA.—Bids are asked until June 21 for constructing 24 to 15-in. pipe sewers in 23 streets. E. M. Bigelow, Dir. Pub. Wks.

PITTSBURG, PA.—Bids are asked until June 18 for constructing a sewer. J. O. Brown, Dir. Dept. Pub. Safety.

BALTIMORE, MD.—The council has voted to appropriate $50,000 for constructing a sewer in three streets.

MOBILE, ALA.—Robt. Hunter and A. S. Benn have petitioned for a franchise to construct a system.

MARION, O.—The extension of the system by the construction of a 10-in. sewer in the East Side is being considered.

HAMMOND, IND.—Bids are asked until June 25 for constructing 4,700 ft. of 42-in. brick sewer. W. F. Bridge, Cy. Engr.

ADRIAN, MICH.—James Blair, Cy. Surv., writes us that bids will soon be asked for constructing 1,851 ft. of 8-in. pipe sewers, average cut 8 ft.; estimated to cost $1,273.

BELVIDERE, ILL.—A. E. Jenner, Cy. Clk., writes us that no contracts for constructing sewers have been awarded, and that probably none will be this year.

GALENA, ILL.—It is reported that the council has voted to construct a system, at an estimated cost of $25,000.

LA SALLE, ILL.—C. H. Nicolet, Cy. Engr., writes us that the city is now building, by day labor, 8,000 ft. of main sewer, ranging from 28-in. brick to 8-in. pipe. The brick used will be home product. The contract for the pipe has not yet been awarded, but probably will be in a few days, as the bids are about all in.

MACOMB, ILL.—Harman & Evans, Consult. Engrs., Peoria, have been engaged to design and superintend the construction of a sewerage system. It is stated that the city and county will build the system jointly.

MATTOON, ILL.—Bids are asked until July 5 for constructing sewers, according to reports. M. B. Fitch, Cy. Engr.

PEORIA, ILL.—It is reported that the Eureka Brick, Tile & Electric Co. has been awarded a contract for furnishing 5,000,000 brick for the West Bluff sewer system, which is being built by the T. B. Townsend Brick & Contracting Co., of Zanesville, O.

SPRINGFIELD, ILL.—The construction of a main sewer 2,000 ft. in length, and estimated to cost about $15 per ft., is being considered; also the construction of a sewer in West Springfield to connect with those of this city.

URBANA, ILL.—G. W. Hubbard, Mayor, writes us that it is proposed to construct six miles of 10 to 6-in. pipe sewers, average cut 9 ft. R. Z. Gill, Cy. Engr.

GRINNELL, IA.—Bids are asked until July 1 for the construction of about 9½ miles of 30 to 8-in. sewers, as noted in our advertising columns. H. H. Robbins, Chn. Com.; J. F. Wilson, Cy. Clk.

WINDOM, MINN.—The citizens have voted to construct sewers, water-works, etc., according to press reports.

OMAHA, NEB.—Bids are asked until June 21 for constructing an 8-in. pipe sewer, according to reports. Address J. H. Winspear.

KANSAS CITY, MO.—The city engineer has about completed plans for extending the O. K. Creek sewer at an estimated cost of $40,000.

ST. JOSEPH, MO.—Chas. W. Campbell, Cy. Engr., writes us that there is no prospect of any further extensions of the system this season, except perhaps a few small pipe sewers.

OAKLAND, CAL.—It is reported that bids will soon be asked for constructing a sewer in the East Side, estimated to cost $41,000.

WOODSTOCK, N. B.—We are informed that this town has decided to begin a system of sewerage, and would like to secure the services of a competent engineer to look the town over and report on a scheme for sewering the whole town; after which a plan, with profile and drawings, will be required. Engineers may address W. S. Saunders, Mayor, or Donald Munro, Supt. W. W.

GARBAGE DISPOSAL.

FALL RIVER, MASS.—Bids have been opened for collecting garbage, the lowest being $12,000. It is reported that a new method of collection is being considered.

ALBANY, N. Y.—It is reported that Mayor Wilson and Dr. F. C. Curtis and P. E. McCabe, Health Comrs., were in Brooklyn last week examining a garbage crematory, and that it is expected that a selection will be made within a few days.

HARRISON, N. Y.—Bids are asked until July 2 for the removal of all the ashes, garbage, etc., from the streets for one year. B. P. Walsh, Town Clk.

KINGSTON, N. Y.—The sanitary committee has been investigating a method of garbage disposal, and is reported as to recommend that the combustible matter be burned and the rest buried and covered with the ashes.

NEW YORK, N. Y.—Deputy Collector Williams, in charge of the Collector's Department of the Public Stores, has been authorized to have built in the basement of the stores a crematory to burn the sweepings from the various floors. These sweepings consist largely of excelsior and other packing. When dumped overboard from the scows this matter floats, and finally gets on the New Jersey and Long Island beaches.

TRENTON, N. J.—The council is considering bids for a garbage crematory. L. Colwell, 39 Cortlandt St., New York, offers to construct a crematory to burn 40 tons of garbage and 10 tons of combustible refuse for $4,250. Thos. J. McGovern has submitted a proposition for the erection of a reduction plant, the garbage to be delivered by the city at a plant to be erected by himself and to be disposed of without expense to the city.

READING, PA.—The "Times" states that the garbage question should be solved in this city as it has been in Pittsburg.

BELLEVUE, O.—The board of health is selecting a site for the disposal of the garbage of the city.

FORT WAYNE, IND.—Press reports state that a delegation from this city went to McKeesport, Pa., last week to examine the garbage crematory at that place.

SAN FRANCISCO, CAL.—Local papers state that the supervisors received two bids for disposing of the garbage and all refuse of the city for 35 years, as follows: H. E. Williams, cash bonus of $2,000 for the franchise, and $28,000 in installments; would cremate all the garbage and refuse and charge 25 cts. per cu. yd. for its removal; would spend $250,000 on a plant. Henry J. Lang, cash bonus of $1,100, and would erect a plant to cost from $125,000 to $325,000, and dispose of the garbage by a chemical process; would charge 20 cts. per cu. yd. for collecting the garbage.

STREETS AND ROADS.

MARLBORO, MASS.—B. R. Felton, Cy. Engr., writes us that an order for paving will be submitted to the council this month, but that there seems little chance of its passing.

ALBANY, N. Y.—Bids are asked until June 17 for grading and macadamizing about 6,250 lin. ft. of the Northern Boulevard. The roadway will be 24 ft. wide and the gutters 3 ft. The work will include about 29,000 cu. yds. of excavation and 21,000 cu. yds. of filling. Horace Andrews, Cy. Engr.; T. J. Lanahan, Clk. Bd. Contract.

BROOKLYN, N. Y.—Thomas Monahan was the lowest bidder for repaving a portion of Fulton St. with granite blocks, at $44,765. Washington Ave., at $36,339. T. D. Bradford was the lowest bidder for paving a part of Schermerhorn St. with asphalt, at $16,986.

BUFFALO, N. Y.—The park commissioners have voted to pave Front Ave. with asphalt.

DUNKIRK, N. Y.—The council has voted to advertise for bids for paving or macadamizing portions of two streets.

GLEN COVE, N. Y. (L. I.)—An election will be held Aug. 6 to vote on the question of issuing $375,000 in bonds for macadamizing and $1,000 for the purchase of a stone crusher, etc. The committee consists of Walter Powell, P. H. Scudder, Townsend D. Cock and James Malcolm.

NEWBURG, N. Y.—Bids are asked until June 18 for grading in one street. D. J. Coutant, Cy. Clk.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvement, 2622 Third Ave., until June 20 for grading portions of four streets.

ROCHESTER, N. Y.—It is proposed to construct cement sidewalks in five streets, at an estimated cost of $12,000, and sewers in two streets, at an estimated cost of $3,500. T. S. Pulver, Cy. Clk.—The following bids were received June 4 for improving South Ave.; estimated cost, $44,500: William H. Jones & Sons, $32,396; Chambers & Casey, $32,988; Lauer & Hagaman, $35,176; Gilbert Brady & Co., $35,321; Whitmore, Rauber & Vicinus, $36,828; H. N. Cowles, $37,597; Brayer & Albaugh, $39,978.

SYRACUSE, N. Y.—Bids are asked until June 17 for grading and improving Borden Ave., and extending the stone arch culvert over Harbor Brook. H. F. Stephens, Cy. Clk.

ELIZABETH, N. J.—It is proposed to pave portions of five streets with trap blocks. N. K. Thompson, St. Comr.

CAMDEN, N. J.—The committee has recommended the paving of portions of nine streets and the construction of sewers in several streets, at an estimated cost of $200,000.

JERSEY CITY, N. J.—Bids are asked until June 17 for 12,300 sq. yds. of Belgian block paving, 46,100 sq. yds. macadam, 4,300 yds. of rock excavation, 18,000 cu. yds. of earth excavation, etc. John C. Kaiser, Chn. Com.—The commissioners have adopted the mayor's recommendation for constructing 15¾ miles of asphalt roads.

ALLEGHENY, PA.—The Sicilian Asphalt Paving Co. has been awarded the contract for paving Sheffield St., at $27,017.—Booth & Flinn, of Pittsburg, have been awarded five contracts for paving with Ligonier blocks.

BELLEVUE, PA.—Bids are asked until June 17 for grading Euclid Ave. W. J. Longmore, Chn. Com.

PHILADELPHIA, PA.—Bids are asked until June 20 for constructing Lincoln Ave. drive. Russell Thayer, Ch. Engr. Fairmount Park Comrs.

PITTSBURG, PA.—Bids are asked until June 21 for grading and paving portions of seven streets with asphalt, etc. Edward M. Bigelow, Dir. Pub. Wks.

TURTLE CREEK, PA.—The Park Paving Co., of Beaver Falls, has been awarded the contract for grading and paving Penn Ave. with brick, at $19,935.

WILKINSBURG, PA.—Bids are asked until June 22 for about 50,000 cu. yds. of grading, 47,000 lin. ft. of curbing, and 76,900 sq. yds. of brick paving, as stated in our advertising columns. Engrs., Edeburn & Cooper, 410 Grant St., Pittsburg.

WILLIAMSPORT, PA.—Bids are asked until June 25 for paving with asphalt or brick on 6 ins. of concrete, as stated in our advertising columns. J. J. Galbraith, Cy. Clk.; Geo. D. Snyder, Cy. Engr.

DAYTON, O.—Bids are asked until June 20 for grading and improving portions of five streets and alleys. C. A. Herbig, Cy. Comptroller.

NEWARK, O.—H. G. Kingsbury, Cy. Engr., writes us that contracts will probably be awarded within 60 days for 9,000 sq. yds. of brick paving, estimated to cost $10,350, and for building 1,000 ft. of 15-in. pipe sewers, average cut 9 ft., estimated to cost $1,100.

OBERLIN, O.—W. B. Gerrish, Cy. Engr., writes us that bids will be asked early in July for about 2,000 yds. of brick paving.

HAMMOND, IND.—Bids are asked until June 25 for brick paving. W. F. Bridge, Cy. Engr.

KOKOMO, IND.—A. W. Smith, Cy. Engr., writes us that it is proposed to pave 10,400 sq. yds. with brick, at an estimated cost of $29,200, which includes cement sidewalks 11½ ft. wide, and stone curbing.

INDIANAPOLIS, IND.—Bids are asked until June 22 for 8,600 sq. yds. of asphalt paving.—Plans have been prepared for 1,400 lin. ft. of brick paving, 3,100 lin. ft. of cement sidewalks and 2,000 lin. ft. of gravel streets. Chas. C. Brown, Cy. Engr.

MATTOON, ILL.—Bids are asked until July 5 for grading and paving two streets with brick, etc., according to reports. M. B. Fitch, Cy. Engr.

LA SALLE, ILL.—C. H. Nicolet, Cy. Engr., writes us that the question of paving 6,000 to 9,000 sq. yds. with brick is being considered.

PONTIAC, ILL.—The council is reported about to be petitioned to pave the streets around the square.

URBANA, ILL.—G. W. Hubbard, Mayor, writes us that it is proposed to pave 8,000 sq. yds. with brick, at an estimated cost of about $14,000. R. Z. Gill, Cy. Engr.

DUBUQUE, IA.—Bids are asked until June 17 for 18,000 sq. yds. of macadam, 11,000 lin. ft. of curbing, about 39,000 cu. yds. of grading, etc. T. J. Cooney, Cy. Recdr.

KANSAS CITY, MO.—The board of public works has voted to pave a portion of 19th St. with brick.—It is proposed to macadamize portions of six streets.

BAKER CITY, ORE.—C. M. Foster and Henry Foster, of Albany, have been engaged by the Commercial Club of this city, to make surveys for a road from Malheur City to Grant county.

MANUFACTURING PLANTS.

CHARLOTTE, N. C.—We are informed that D. R. Julian and F. M. Thompson, of Salisbury, N. C., contemplate the erection of a roller flour mill at this place, and will award the contract for furnishing the machinery for the same as soon as the buildings are completed.

DURHAM, N. C.—A knitting mill for the manufacture of hosiery and underwear will at once be equipped by Julian S. Carr and others, according to information sent this office.

FRANKLINTON, N. C.—Contracts will soon be awarded for the entire equipment of a cotton mill of about 5,000-spindle capacity, to be operated by steam. Pres., John F. Cunaday; Secy., S. C. Vann.

RUTHERFORDTON, N. C.—Buildings for a cotton mill of about 10,000 spindles capacity are being erected by W. H. Morris, and we are informed that contracts for the entire equipment will soon be awarded. Steam power will be used.

SALISBURY, N. C.—A correspondent writes us that W. T. Littman will soon award contracts for the entire equipment of a factory for manufacturing ball twine, which he proposes to establish.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

STREET SPRINKLING.—Syracuse, N. Y.—Bids are asked until June 17 for street sprinkling. H. F. Stephens, Cy. Clk.

FERRY DROP.—Boston, Mass.—Bids are asked until June 18 for building a ferry drop. Address Thos. Kellough, Supt. of Ferries, East Boston.

DREDGING.—Raleigh, Ont.—Bids are asked until July 2 for dredging work in the townships of Raleigh and Tilbury East, in Kent county, estimated to cost $48,428. Engr., W. G. McGeorge; J. G. Stewart, Clk. County Comrs.

DAM.—Philadelphia, Pa.—Bids are asked until June 20 for the construction of Lincoln Ave. drive and building dam, Wissahickon, Fairmount Park. Russell Thayer, Ch. Engr.

DREDGING.—Albany, N. Y.—The governor has signed

a bill appropriating $15,000 for dredging the Albany basin; also a bill appropriating $3,000 for improving the West Troy basin.

STREET CLEANING.—Corning, N. Y.—The contract for street cleaning for five years has been awarded to W. J. Hewlett. The property owners unite with the city in the expense. Harry C. Heermans, Cy. Engr.

SEA WALL.—Riverhead, N. Y. (L. I.)—Governor Morton has signed a bill appropriating $10,000 for a stone wall to prevent the sea from washing away the highway between the villages of East Marion and Orient.

BOILER RIVETS, ETC.—New York, N. Y.—Bids are asked until June 18 for a quantity of rivets, steel plates, angle bars, etc., for the Brooklyn navy yard. Address Edwin Stewart, Paymaster-General, Washington, D. C.

LOCK.—Mobile, Ala.—W. T. Nicol, of the U. S. Engineer Office, has returned to the city from St. Stephens, where he went to make surveys and preparations for the erection of a lock at McGrew's shoals on the Tom Bigbee River, about 65 miles above Mobile, according to press reports, which state that about $96,000 is available for this work.

TUNNEL.—Pottsville, Pa.—R. C. Luther, Gen. Supt., Philadelphia & Reading Coal & Iron Co., writes us that the reports in regard to resuming work on an unfinished tunnel at Tower City, on which work was started about 40 years ago, are premature. The tunnel would extend through the mountain to Ranch Gap and open up a rich track of coal land, but no arrangements have yet been made for resuming the construction, and it is not known at present when the matter will be taken up.

SHIP CANAL.—Boston, Mass.—A press report states as follows: Benjamin J. Berry, one of the promoters of the Cape Cod Ship Canal bill, which became a law June 5, and who has been for 10 years endeavoring to secure the passage of such a bill, states that the incorporators, all of whom are Massachusetts men, are prepared to begin at once the work of construction at Bass River, between the towns of Yarmouth and Dennis; that they feel sure of success, and that in two years ships will be passing through the canal. The work is expected to cost from $5,000,000 to $8,000,000. The incorporators are Oliver Ames, Benjamin J. Berry, John H. Dane, Chas. A. Campbell, Wm. F. Humphrey, Henry N. Berry, Isaac C. Wyman, Chas. P. Mudge, Albert W. Hurd, Benjamin F. Peach, Jr., Joseph T. Wilson, and Geo. W. Eldridge.

GOVERNMENT SURVEYS.—Olympia, Wash.—Wm. P. Watson, U. S. Surveyor-Gen., writes us that contracts for the survey of public lands of this state, to the amount of $28,000, have just been let. The following is a list of the U. S. Deputy Surveyors having contracts for the survey of the public lands, for the fiscal year 1895, with townships to be surveyed:

Deputy.	Townships.
I. M. Galbraith, Saxon..	T. 39 N.R. 4 E.—T. 38 N.R. 5 E.
I. M. Galbraith, Saxon..	T. 37 N.R. 8 E.—T. 37 N.R. 9 E.
E. J. Hermans, Balch....	T. 33 N.R. 7 E.—T. 30 N.R. 8 E.
P. E. Thian, Everett....	T. 29 N.R. 9 E.—T. 30 N.R. 9 E.
J. C. Parsons, Mt. Vernon.	T. 36 N.R. 9 E.—T. 36 N.R. 11 E.
C. Anderson, Portland* ...	.....
Scurry & Owens, N. Yakima	T. 40 N.R. 40 E.—T. 40 N.R. 41 E.
" " " "	T. 36 N.R. 40 E.—T. 36 N.R. 39 E.
" " " "	T. 32 N.R. 37 E.—T. 32 N.R. 38 E.
" " " "	T. 33 N.R. 38 E. .....
J. Richardson, Goldendale	T. 4 N.R. 7 E. .....
I. Worthington, Spokane..	T. 29 N.E. 21 E. .....
H. L. Pike, Pt. Roberts.	T. 41 N.R. 3 W. .....
A. Bystrom, Montesano..	T. 26 N.R. 2 W.—T. 26 N.R. 3 W.
E. A. FitzHenry, Pt Angeles.	T. 24 N.R. 11 W.—T. 27 N.R. 11 W.
Hammond & Fortman, Port Townsend	T. 33 N.R. 13 W.—T. 33 N.R. 14 W.
Hammond & Fortman, Port Townsend	T. 31 N.R. 16 W. .....
R. F. Whitham, Olympia.	T. 21 N.R. 6 W.—T. 21 N.R. 7 W.
D. S. B. Henry, Olympia.	T. 24 N.R. 3 W.—T. 24 N.R. 4 W.
Webster Brown, Seattle..	T. 22 N.R. 5 W. .....
O. O. Ort, Centralia.....	T. 22 N.R. 9 W.—T. 23 N.R. 9 W.

* Oregon; all others Washington.

CONTRACT PRICES.

HYDRANTS.—Reading, Pa.—A contract for 50 hydrants has been awarded to the Mellert Foundry Co., at $29 each.

BRICK PAVING.—Ashtabula, O.—The bids for paving three streets with brick, opened June 1, ranged from 59½ to 72 cts. per sq. yd. H. E. Mann, Cy. Engr.

CAST IRON PIPE.—Toledo, O.—T. R. Cook, Supt., writes us that the lowest bid for furnishing pipe for the proposed 30-in. main in the west side of the city was that of the Michigan Peninsular Car & Iron Co., of Detroit, at $16.85 per ton of 2,000 lbs.

ASPHALT PAVING.—Indianapolis, Ind.—Bids were received May 28 for asphalt pavement on Fort Wayne Ave., 1,257 x 27 ft., from the Western Paving & Supply Co., at $5.11 a lin. ft. of each side of the street, the Indiana Bermudez Co. and the Warren-Scharf Asphalt Paving Co., each at $5.20, the Fruin-Bambrick Construction Co., of St. Louis, at $3.60 for Berea stone and $3.70 for stratified limestone curb, and the Mexican Asphalt Paving Co., at $4.90, awarded to the Western Paving & Supply Co. The Mexican Co. proposes to use asphalt from Lake Chapopotal in Vera Cruz, Mex. The work includes 4,371 sq. yds. of asphalt on 6-in. Portland cement concrete, 2,483 ft. of stratified limestone curb, 38 ft. of granite round corners of 4 ft. radius, 110 ft. of 10 ft. radius, 71 ft. of 15 ft. radius, 64 ft. of 40 ft. radius, 298 ft. of marginal stone, 1 catchbasin and 7 inlets. The city engineer estimates that without curb and sewer connections the bid of $5.11 above given is equivalent to $2.37 a sq. yd., and that the Portland cement in the concrete and the granite in round corners add 27 cts. to the cost under last year's specifications, so that on the basis of those specifications the cost would be $2.10 a sq. yd., a reduction of 62 cts. from the bids of a year ago, and of 10 cts. from the last ones of last year, although 40 cts. or so above the prices of part of the summer and fall.

PIPE AND VALVES.—La Crosse, Wis.—The board of public works on June 6 awarded a contract for 70 tons of 30-in. and 75 tons of 20-in. cast iron pipe to Benedict Ott, at $22.75 per ton, and 20 tons of special castings at 2½ cts. per lb. The Chattanooga Foundry & Pipe Works bid $22.50, and 2¼ cts., respectively, and the Anniston Pipe & Foundry Co., $22 for 30-in., and $22.50 for 20-in., and 2¼ cts. per lb. for castings. The contract for two 8-in., nine 16-in., one 20-in. and two 30-in. valves was awarded to the Chapman Valve Co., at $1,562.

SEWERS.—Auburn, N. Y.—Bids were received and opened June 3 for constructing the second, seventh, eighth and ninth ward sewer, as advertised in Engineering News. The bids were separate for each of the four sections, and were as follows; contract will probably be awarded to L. D. Hulbert, the lowest bidder; Cy. Engr., De Witt F. Austin:

Section No. 1, average depth, 12.3 ft.

	L. D. Hulbert, Syracuse.	T. F. Moore, Buffalo.	D. W. Barnes & Son, Auburn.	N. C. Reid, Auburn.
24-in. brick, 4-in. walls, 5,270 ft.	$2.25	$1.70	$4.15	$4.50
5-in. vitrified tile, 1,650 ft.	.35	.40	.50	.45
24-in. cast iron, 370 ft.	3.00	5.00	5.50	6.00
Inlets, with catchbasins, 2.	25.00	50.00	50.00	50.00
Manholes, 13	25.00	40.00	38.00	48.00
Rock, per cu. yd.	1.00	2.00	3.25	3.75
Concrete, per cu. yd.	4.50	5.00	3.00	3.25
Lumber, per M. ft.	12.50	25.00	15.00	14.00

Section No. 2, average depth, 10.2 ft.

18-in. vitrified tile, 500 ft.	$1.25	$1.58	$1.80	$2.00
15-in. " " 1,332 ft.	.95	1.00	1.17	1.00
5-in. " " 850 ft.	.35	.40	.30	.45
Inlets and catchbasins, 2.	25.00	50.00	40.00	45.00
Manholes, 4	25.00	40.00	35.00	40.00
Rock, per cu. yd.	.80	2.00	3.00	3.50
Concrete, per cu. yd.	4.50	5.00	3.00	3.00
Lumber, per M. ft.	8.00	25.00	15.00	14.00

Section No. 3, average depth, 9.72 ft.

18-in. vitrified tile, 3,002 ft.	$1.05	$1.63	$1.80	$2.00
18-in. cast iron, 408 ft.	2.40	5.00	4.50	4.50
5-in. vitrified tile, 700 ft.	.30	.40	.42	.40
Manholes, 7	25.00	40.00	35.00	40.00
Rock, per cu. yd.	.70	2.00	3.00	3.50
Concrete, per cu. yd.	4.50	5.00	3.00	3.00
Lumber, per M. ft.	8.00	25.00	15.00	15.00

Section No. 4, in water and on land to grade.

24-in. riveted steel, 1,085 ft.	$3.00	$4.67	$4.75	$4.50
Manhole, 1	10.00	40.00	38.00	40.00
Rock, per cu. yd.	1.25	2.00	3.50	3.50
Concrete, per cu. yd.	5.00	5.00	3.00	3.50
Lumber, per M. ft.	10.00	25.00	15.00	14.00

ASPHALT, BRICK AND STONE PAVING.—Philadelphia, Pa.—The "Record" states that bids were opened June 4 for about $1,000,000 worth of paving and grading work on 69 streets in various parts of the city. There are 38 streets to be paved with asphalt, for which there were five bidders, including the Vulcanite Paving Co., the Pennsylvania Asphalt Co., and the Philadelphia Paving Construction Co. There were 14 bidders for vitrified brick paving on 22 streets, and 10 bidders for granite paving on eight streets. The bids show a considerable reduction in price from former bids by the same contractors. For instance, on Bermudez asphalt the average price was about $2.20 per sq. yd., while the last average was about $2.45. On land asphalt, the last bids averaged about $1.95 per sq. yd., the former average being about $2.25. For vitrified brick paving the last bids run from $1.70 to $2.50, averaging about $1.80. The lowest bid on previous contracts was about $2.05. For the granite block paving the lowest bid was $2.87. The lowest bid on previous contracts was $3.20.

DITCH EXCAVATION.—Maple Park, Ill.—The following bids were received by the drainage commissioners of Union drainage district No. 3 of the towns of Virgil, in Kane county, and Cortland, in De Kalb county, June 1 for the construction of open ditches, the main ditch being about seven miles in length, average cut 6.2 ft., and containing about 150,000 cu. yds. of excavation; branch No. 1, about two miles in length, average cut 6.1 ft., and containing 30,000 cu. yds.; and branch No. 2, about 5½ miles in length, average cut 6.5 ft., and containing 90,000 cu. yds.:

Bidder.	Excavation, per cu. yds.—Main ditch, cts.	Branches—No. 1, cts.	Branches—No. 2, cts.	Total bid.
R. H. McWilliams & Co..	5½	6¾	6¾	$16,375
E. O. Rood	6.8	6.8	7.7	19,170
C. & T. Inglehart	7.2	7.2	7.2	19,440
A. V. Wills & Son	6.5	6.5	10.0	20,700
Wilson & Jackson	8	8	8	21,600
C. T. Henning	7½	9.9	9.9	23,130
H. D. Hallet	...	...	12½	.....
Casgrain & McDonald	...	9.9	9.9	.....
A. W. Karch	...	...	8.95	.....
C. Goff & Co.	...	6.71	6.71	.....
Stafford & Bacon	6.0	...	...	.....
McGinnis & Co.	6¾	6¾	...	.....

CEMENT SIDEWALKS.—Indianapolis, Ind.—Contracts were let June 4 to Julius Keller for cement sidewalk on Maryland St., 15 ft. wide, at $1.79 a lin. ft., other bids ranging from $1.79 to $1.98; also on Meridian St., 12 ft. wide, at $1.32 a lin. ft., other bids being $1.42 to $1.55; also to B. Porter for cement walk on Ohio St., 8 ft. wide, at 91 cts. a lin. ft., other bids being 95 cts. to $1.04.

PUMPING ENGINE.—Cambridge, Mass.—L. M. Hastings, Cy. Engr., writes us that the contract for a 20,000,000-gallon pumping engine has been awarded to the Groshon High Duty Pumping Co., New York, the bids being as follows:

Atlantic Works, East Boston	$158,000
Union Iron Works, San Francisco	152,000
I. P. Morris Co., Philadelphia	131,000
George F. Blake Mfg. Co., Cambridge	117,000
Groshon High Duty Pumping Co., New York	86,000

BRICK PAVING.—Indianapolis, Ind.—Contracts were let May 25 for brick sidewalks 5 ft. wide, with curb, at 51½ cts. a lin. ft., to D. R. Marshall, one other bid being 81 cts. Also for cement sidewalk on 11th St., 5 ft. wide to F. M. Dunn, at 59 cts. Other bids ranged from 65 to 72 cts. Contracts were let May 28 for brick pavement on Christian Ave., 80 x 27 ft., with curb and broken stone under street railway tracks, to the Indiana Paving Brick Co., at $3.05 a lin. ft. of each side of the street. Also for paving College Ave. with brick 1,360 x 36 ft., to the same company at $4.35 a lin. ft. of each side of the street. The work includes 5,932 sq. yds. of brick surface and 6 ins. Portland cement concrete, 2,440 sq. yds. of broken stone foundation 6 ins. deep under street railway tracks, 2,538 ft. of stratified limestone curb, 100 ft. of granite corner, 4 ft. radius, and 94 ft. 6 ft. radius, 349 ft. of marginal stone, 3 catchbasins and 17 inlets. Also for grading and graveling Wilson St., 24 ft. wide, with 5-ft. brick sidewalks and curb, to J. E. Mann, at $1.32 a lin. ft. of each side of the street. Other bids were from $1.54 to $1.65. Also for cement sidewalks on Prospect St., west of Pleasant Ave., 6 ft. wide, to J. Keller, at 71 cts. a lin. ft., and east of Pleasant Ave., 5 ft. wide, to the same, at 61 cts. a lin. ft.

TUBE WELLS.—Lowell, Mass.—Geo. Bowers, Cy. Engr., writes us that the contract for a tube well plant as advertised in Engineering News, has been awarded to B. F. Smith & Bro., Boston, at $13,416.70 per million gallons. This was the lowest bid.

BRICK PAVING.—Quincy, Ill.—Bids have been received for 25 blocks of brick paving, six contracts, the bidders being the Winona Construction Co., Talbot Paving Co., Geo. F. Miller, T. J. Shea, and Peter Simons. The lowest bids were $1.04 to $1.07 per sq. yd. for paving and 31 cts. per lin. ft. for curbing. Last year a contract for paving several streets with brick was awarded to the Winona Construction Co., at $1.20, which was then considered very low. The city has since done some paving by day labor, at a cost of about $1.06 per sq. yd.

ASPHALT PAVING.—Utica, N. Y.—The contracts for paving Broad St. and Seymour Ave. with asphalt have been awarded to the Warren-Scharf Asphalt Paving Co., at $2.08 and $2.27 per sq. yd., $38,328 and $16,879, respectively, for the two contracts. The Utica Paving Co. bid $2.45 per sq. yd., and Michael Bennett, $2.30. The contract for paving Varick St. was awarded to the same company, at the following prices: For tile drains, 10 cts. per lin. ft.; resetting curb, 12 cts. per lin. ft.; new curb and setting, 28 cts. per lin. ft.; catchbasins, $30 each; branch pipe, straight, 35 cts. per lin. ft.; curves, bends and branches, $1 each; manholes, $40 each; asphalt paving, $2.62 per sq. yd.; repaving, cobble and other stone, 20 cts. per sq. yd.; relaying crosswalks, 4 cts. per sq. ft.; new sandstone crosswalks, back of curbs, 18 cts. per sq. ft.; concrete, extra for foundation, $5 per cu. yd.; moving catchbasins, $15 each. Credit—Old cobblestone, 12 cts. per sq. yd.; old crosswalk stone, 3 cts. per sq. ft. The total bids for this work were as follows: Utica Paving Co., $12,242; Warren-Scharf Asphalt Paving Co., $11,750; Trinidad Asphalt Refining Co., $11,948; Syracuse Improvement Co., $11,571.

SEWERS.—Washington, D. C.—The following bids were received by the district commissioners June 3 for constructing sewers:

Bidder.	Section A, 2.25 x 3.375 ft., brick or con.	Section B, 24-in. pipe.	Section C, 21 and 18-in. pipe.	Section D, 12-in. pipe.	Section E, 24, 21 and 18-in. pipe.	Section F, 15, 12 and 10-in. pipe.	Section G, 21 and 18-in. pipe.	Manholes.
Lyons Bros.	$4.90[1]	$1.95	$1.85[2]	$1.58	$1.93[3]	$1.40[4]	$1.78[5]	$30
	4.49[2]	.....	1.78[3]	.....	1.80[6]	1.20[6]	1.57[13]	...
	.....	.....	.....	.....	1.95[7]	1.20[10]	.....	...
J. P. Larguey	5.45[1]	2.25	.....	.....	.....	.....	1.85[11]	26
	5.15[2]	.....	.....	.....	.....	.....	1.75[12]	28
E. G. Gummel	5.82[1]	2.16	1.98[3]	1.38	1.95[6]	1.57[8]	1.89[11]	38
	5.24[2]	.....	1.78[3]	.....	1.84[6]	1.26[9]	1.75[12]	28
	.....	.....	.....	.....	1.60[7]	1.10[10]	.....	27
	.....	.....	.....	.....	.....	.....	.....	25
Lamb & Darby	5.50[1]	2.40	2.10[3]	1.25	2.35[6]	1.55[8]	2.18[11]	27
	5.15[2]	.....	1.80[3]	.....	1.95[6]	1.25[9]	1.80[12]	25
	.....	.....	.....	.....	2.00[7]	1.25[10]	.....	...
T. Buckley	5.60[1]	2.07	1.87[3]	.95	1.95[6]	1.21[8]	1.85[11]	21
	5.10[2]	.....	1.75[3]	.....	1.80[6]	1.00[9]	1.75[12]	22
	.....	.....	.....	.....	1.65[7]	.85[10]	.....	23
	.....	.....	.....	.....	.....	.....	.....	19
*J. Jacoby	4.70[1]	2.20	1.90[3]	1.25	2.20[6]	1.50[8]	1.75[11]	35
	.....	.....	1.60[3]	.....	1.75[6]	1.40[9]	1.50[12]	40
	.....	.....	.....	.....	1.70[7]	1.25[10]	.....	45
Bolden & Wormley	5.98[1]	2.50	2.35[3]	2.50	2.50[6]	2.44[8]	2.55[11]	25
	3.95[2]	.....	2.25[3]	.....	2.49[6]	2.44[9]	2.50[12]	28
	.....	.....	.....	.....	2.46[7]	2.44[10]	.....	25

* Wilmington, Del.; all others Washington, D. C. [1] Brick. [2] Concrete. [3] 21-in. [4] 18-in. [5] 24-in. [6] 21-in. [7] 18-in. [8] 15-in. [9] 12-in. [10] 10-in. [11] 21-in. [12] 18-in.

CEDAR BLOCK PAVING.—Minneapolis, Minn.—The contract for all the cedar block paving to be laid during the season of 1895 has been awarded to Canney Bros., of Minneapolis, at 78 and 78½ cts. per sq. yd.

GRADING AND CEDAR BLOCK PAVING.—Racine, Wis.—Local papers state that the following bids were received June 1 for grading South Main St. from 6th to 14th St.: W. J. Higgie, 14½ cts. per cu. yd.; R. R. Birdsall, 15 cts.; Rasmussen & Johnson, 15 cts.; Jas. Cape & Sons, 18.8 cts.; N. F. Reichert & Co., 16 cts.; and that the bids for paving the street with cedar blocks on a concrete foundation were as follows:

	Paving, per sq. yd.	Curbing, per ft. New.	Curbing, per ft. Reset'g old.
J. O. Jones, Racine	$1.40[3]/4	$0.46	$0.12
P. W. Galloway, Racine	1.48½	.48½	.10
Rasmussen & Johnson, Racine	1.35	.50	.10
N. F. Reichert & Co., Racine	1.00¾	.44	.10
W. R. Jones	1.23	.47	.08
Garden Cy. P'v'g & Post Co..	1.25	.45	.09
Starke & Co., Racine	1.19	.58	.08
J. B. Smith & Co., Chicago	1.07	.42	.15
Jas. Cape & Sons, Racine	1.07	.45	.14

BRICK PAVING.—Canton, Ill.—The contract for about 1¼ miles, 27,000 sq. yds., of paving with two courses of small brick upon 5 ins. of sand, as advertised in Engineering News, has been awarded to H. D. Daugherty, of Canton, at 15 cts. per cu. yd. for excavation, 36 cts. per lin. ft. for curbing and $1.05 per sq. yd. for paving. Separate bids were received for each of the six districts, the bids for district No. 1 being as follows:

Bidder.	Excav., cu. yd.	Curb., lin. ft.	Paving, sq. yd.
Daniel Ryan, Alton	$0.17½	$0.52½	$1.30¾
John Cherry, Jr., Jacksonville.	.18	.44	1.18
Talbot Paving Co., Detroit	.22	.50	1.33
J. B. McCauley, Galesburg	.22	.45	1.29
H. D. Daugherty, Canton	.15	.36	1.05
G. S. Miller, Ottawa	.22	.39½	1.17.9
H. L. Pierce & Son, Lincoln.	.21	.48	1.20
Patterson & Shriffler, Sp'field	.18	.44	1.17
Edwards & Walsh Cons'n Co.	.25	.41	1.17
J. S. Allen, Galesburg	.19	.43	1.19

INDUSTRIAL NOTES.

THE O. S. KELLY CO., of Springfield, O., has a contract for a 25,000-lb. steam road roller for Medina, O.

THE LAFAYETTE BRIDGE CO., of Lafayette, Ind., has been awarded the contract for seven steel bridges for the Louisville, New Albany & Chicago Ry.

CARKIN, STICKNEY & CRAM, of Bay City, Mich., contractors for dredging, dockwork, etc., are said to be about moving their plant and offices to Detroit.

THE CARNEGIE STEEL CO., of Pittsburg, Pa., has a contract for 80-lb. rails for relaying 30 miles of track between Elmira and Salamanca, N. Y., on the New York, Lake Erie & Western R. R.

THE EUREKA BRICK, TILE & ELECTRIC CO., of Eureka, Ill, has the contract for 5,000,000 sewer bricks for the sewer system of Peoria, Ill. It has recently ordered a steam dryer with a daily capacity of 30,000 bricks.

THE LIMA LOCOMOTIVE WORKS, of Lima, O., is building two 65-ton engines for the Buffalo & Susquehanna R. R., a 28-ton engine for the Salt Lake & Mercer R. R., and other engines for logging roads. All these engines are of the Shay geared type.

THE LEWIS & FOWLER MFG. CO., of Brooklyn, N. Y., has had consolidated with it the Lewis & Fowler Girder Rail Co. The former company has a capital stock of $300,000, and the latter $200,000. Both have been in financial difficulties, but it is thought the reorganization will increase their strength.

R. W. HILDRETH & CO., civil and inspecting engineers, 50 Broadway, New York, announce that the copartnership existing between Russel W. Hildreth and Percy S. Hildreth has been dissolved, and a new partnership formed between R. W. Hildreth and Alfred Liebman, doing business under the same firm name.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has an order from the Norwalk Tramway Co., of Norwalk, Conn., for a car barn 45 × 160 ft., constructed entirely of iron, and has also the contract for the steel bridges for the Central Railway & Electric Co., of New Britain, Conn., for its various extensions.

THE GILBERT CAR MFG. CO., of Green Island, N. Y., will have its plant and property sold at auction at the company's office on July 2. The works are extensive, and are adapted for the manufacture of cars for steam and street railways. For particulars address Wm. Shaw, receiver, Gilbert Car Mfg. Co., Troy, N. Y.

THE BLOOMSBURG CAR MFG. CO., of Bloomsburg, Pa., is introducing a cheap and strong form of side dump car for rough work and contractors' use. The boxes are bolted directly to the sills, and have a large oil capacity. The cars are of 1½, 2 and 2½ cu. yds. capacity, weighing 2,150 to 2,740 lbs., and cost about $45.

THE RAILROAD SUPPLY CO., Owings Building, Chicago, Ill., has been organized to manufacture the Wolhaupter tie-plate, the Hien double automatic coupler, air-brake pressure regulators and other railway appliances. Pres., D. S. Wegg; Treas., W. E. Duncombe; Man. of Sales Dept., Arthur Crandall; Man. of Eng. Dept., B. Wolhaupter.

A LARGE STEEL PLANT is rumored as likely to be established in the near future for the manufacture of armor plate and heavy ordnance, under the patents of John A. Potter, formerly Superintendent of the Carnegie Steel Co. The financial backing is said to be furnished by John D. Rockefeller, of the Standard Oil Co., and the works will probably be situated in or near Cleveland.

THE RANSOME SUBWAY CO., 269 Dearborn St., Chicago, Ill., has been incorporated to develop more extensively the patents of E. L. Ransome, as noted in our advertising pages. It has molding devices for all kinds of subway, such as water and sewer pipe, electric and cable conduits, irrigation canals, tunnels, etc. The process was described and illustrated in our issue of April 4. Pres., Ernest L. Ransome.

ALLEN, FARRINGTON & CO. is the firm name of a new copartnership carrying on a surveying and engineering business at Syracuse, N. Y., as successor to the firm of Mather & Allen, the latter partnership having been dissolved. The old firm was composed of Henry C. Allen, Theo. W. Clarke, Thos. H. Mather and C. Loomis Allen. The new firm is composed of Henry C. Allen, M. Am. Soc. C. E., City Engineer; W. S. Farrington, formerly Chief Draftsman of the Syracuse water-works, and Theo. W. Clarke. The offices are in the Kirk Building, Syracuse, N. Y.

NEW COMPANIES.—Vacuum Ventilating Co., St. Louis, Mo.; $50,000; G. M. Tiffany, A. M. Tibbett and George Huft.

Superior Wire Mat Co., Beaver Falls, Pa.; $12,000, with $1,200 paid in; Treas., Charles E. Meyers.

Continental Contract Co., Chicago, Ill.; $100,000; James L. Osborn, H. W. Williams and J. E. Davies.

St. Louis Asphalt & Paving Co., East St. Louis, Ill.; $10,000; Griffith Colt, J. E. Weber and M. Kraemer.

Underwood Dredging Co., Chicago, Ill.; $300,000; Harry L. Burnett, Fred McClery and Washington Laycock.

Allentown Foundry & Machine Works, Allentown, Pa.; $50,000, with $5,000 paid in; Treas., Winslow Wood.

Wrought Steel Bolster Co., East St. Louis, Ill.; $500,000; George A. Bannatine, Warren B. Outen and John C. Wends.

Automatic Sewer Trap Co., New York, N. Y.; $25,000; Lewis W. Pope and Gerrett C. Hallenbake, of Brooklyn, N. Y., and Walter West, of New York.

Harrisburg Mfg. & Boiler Co., Harrisburg, Pa.; $100,000, with $10,000 paid in; Pres., Charles A. Disbrow, Harrisburg; Treas., H. J. Forney, Penbrook.

Electrozone Co., New York, N. Y.; disinfectants and deodorizers for water and sewage, and the treatment of garbage; Adolphus Bonzano, Albert B. Woolf and John A. Barham.

American Gas Reduction Co., New York, N. Y.; $25,000; automatic gas regulators; Richard V. Schoonmaker and Louis S. Friess, of New York, N. Y.; and J. B. Turner, of Elizabeth, N. J.

VALUABLE ITEMS.

Much of the very best information published in our Construction News comes to us from subscribers who send items in reference to work with which they are connected or in which they are interested. Such reliable items are not only greatly desired by us, but frequently result in much good to the sender, by bringing his name and his work to public attention. If you are not already doing so, we ask you, hereafter, to send us the earliest possible information of work that comes under your notice.

NINETY-NINE INCHES

of proposal advertisements were printed in Engineering News of June 6. This work was brought to the attention of prominent contractors in all parts of the country, and the publicity thus given to it doubtless saved many thousands of dollars on the contracts. We ask you to advertise your work in this paper. This is positively the most efficient, as well as the most economical, method of securing healthy competition on projected work.

CONTRACT WORK

of all kinds, and in any section of the United States or Canada, should be advertised in Engineering News, which is probably read by a greater number of prominent contractors each week than are any other five papers in this country.

MORE THAN 150 REPLIES were received, an engineer writes us, from a recent insertion of a water-works advertisement in Engineering News. It would have taken a large number of daily papers and cost a considerable sum of money to have secured this result by the old-fashioned method of advertising work only in daily papers.

NEW BEDFORD WATER WORKS.

NOTICE TO CONTRACTORS.

Sealed proposals will be received at the office of the New Bedford Water Board, New Bedford, Mass., until two o'clock of Wednesday, June 26, 1895, and at that time will be publicly opened and read.

Each bid to be accompanied by a certified check for $2,000, and the successful bidder to furnish a bond for $50,000, the sureties to be residents of Massachusetts.

The Engineer's estimate of the work to be done and by which the bids will be canvassed is as follows:

8,000 cubic yards soil excavated,
3,000 cubic yards soil excavated from spoil bank,
4,600 square yards sodding,
6 acres of seeding,
135,000 cubic yards earth excavation,
100 cubic yards rock excavation,
10,500 cubic yards concrete masonry,
75 cubic yards brick masonry,
7,500 cubic yards rubble stone masonry in mortar,
300 cubic yards dry rubble masonry,
40 cubic yards dimension stone masonry,
900 square feet hammered dressing of dimension stone,
375 cubic yards of coping,
40 square yards of floor paving in mortar,
100 lineal feet laying 48-inch pipes,
110 lineal feet laying 36-inch pipes,
150 lineal feet laying 8-inch pipes,
550 lineal feet laying 6-inch pipes.

The Water Board reserves the right to reject any or all bids.

Specifications may be obtained and plans seen at the office of the Water Board, City Hall, New Bedford, Mass.

DAVID L. PARKER,
OLIVER PRESCOTT,
DAVID KEMPTON,
EDMUND WOOD,
THOS. B. TRIPP,
New Bedford Water Board.

R. C. P. COGGESHALL,
Superintendent.
GEO. S. RICE and
GEO. E. EVANS,
Engineers.

New Bedford, Mass., June 12, 1895. 24-1t

TO BRIDGE BUILDERS.

Sealed proposals for repairs to the Highway Bridge over the Lehigh River at the Borough of Freemansburg, Pa., consisting of a new superstructure and additions to the substructure and the removal of a wooden bridge and a portion of its substructure now standing at said place, in accordance with maps, plans, specifications and contract on file with the undersigned and at the office of J. M. Porter, Civil Engineer, Easton, Pa., will be received by the Commissioners of Northampton County, Pa., at their office until 11 o'clock a. m., June 21, 1895.

All bids must be made upon the blank forms as furnished by the Commissioners; must give prices proposed both in words and figures; be signed by the bidder with full name and address and indorsed "Proposal for Freemansburg Bridge."

Each bid must be accompanied by a properly certified check for the sum of five hundred dollars, payable to the order of the Commissioners of Northampton County, which check will be returned to the bidder, unless forfeited, as hereinafter provided, and no bid will be considered which is not accompanied by such check.

A bond will be required for the faithful performance of the contract, in such sum as shall be fixed by the Commissioners, after the bids are opened; said sum to be not less than one-fourth and not more than one-half the amount of the contract, the sureties to be residents of Pennsylvania and satisfactory to the Commissioners.

The contract must be signed and the bond furnished within six days (Sunday excepted) after the date of the notification by the undersigned of the acceptance of the bid and the readiness of the contract for signature; and in case of the failure of the bidder, after such notification, to execute the contract and furnish the bond within said time, the proposal will be considered as having been abandoned and the certified check accompanying the bid shall be forfeited to the said Commissioners as liquidated damages for such failure.

Plans and specifications and form of proposal can be obtained at the office of J. M. Porter, Engineer, Easton, Pa., on and after Monday, June 10, upon the payment of five dollars.

The Commissioners reserve the right to reject any and all bids should they deem it advisable so to do.

M. H. SHALL,
Clerk.

Easton, Pa., June 10, 1895. 24-1t

CORNWALL-ON-HUDSON, N. Y., WATER-WORKS.

NOTICE TO CONTRACTORS.

Sealed proposals addressed to the Board of Water Commissioners and indorsed "Proposals for Water-Works," will be received until 3 p. m., Friday, July 5, 1895, and opened immediately thereafter, for the furnishing of all material and performing all the work necessary to construct complete a system of water-works for Cornwall-on-Hudson.

The work includes the furnishing of approximately:

900 tons cast iron pipe 14 in. to 4 in. diameter.
10 tons special castings, ordinary.
4 tons special castings, special.
35 valves.
30 valve boxes.
50 double nozzle hydrants.
2 triple nozzle hydrants.
An impounding reservoir of 56,000,000 capacity.
A masonry distributing reservoir.
Also the laying of eight miles of pipe.

Bids will be received for the above in whole or in part. The right is reserved to reject any or all bids. A certified check, three per cent. of the amount of the bid must accompany each proposal. Plans and specifications can be seen at the office of the Board at Cornwall and plans can also be seen and specifications secured at the office of the engineer, 137 Broadway, New York, on or after June 26, 1895.

CARLOS H. STONE, President.
SAMUEL CALL,
HENRY N. CLARK,
CHAS. A. HEDGES,
WILLIAM A. SEAMEN.
Board of Water Commissioners.

ALEXANDER POTTER,
137 Broadway, New York, Chief Engineer.
CHAS. H. WOOD
Clerk. 24-4t

WATER-WORKS, PERRYSVILLE, O.

NOTICE TO CONTRACTORS.

Sealed bids will be received by the water-works trustees until 2 o'clock p. m., June 25, 1895, for the material and work necessary to complete the water-works system of Perrysville, O., in accordance with plans and specifications therefor, consisting, approximately, of about two miles of 6 and 4-in. pipe, with machinery, material and labor, to complete the works. Each bid must be accompanied by cash or certificates of deposit for 3 per cent. of amount bid.

Trustees reserve right to reject any or all bids.

Water-works Trustees:
A. W. BUDD, Chairman.
S. N. ALBAN, Clerk.
M. HILTON.

PERRYSVILLE, O., June 10. 24-1t

STREET PAVING, WILLIAMSPORT, PA.

Sealed proposals will be received by the Joint Highway Committee of Councils of the City o Williamsport, Pa., until 12 o'clock noon, Tuesday, June 25, 1895, for the paving of West Fourth street from Elmira to Campbell, from curb to curb, with a six-inch concrete foundation in accordance with city specifications, foundation to be covered by a wearing surface of vitrified brick or asphalt, and to be in accordance with city specifications as adopted by council. A certified check for one thousand dollars to accompany each bid, to be forfeited to the city in case contractor refuses to execute contract, if awarded under his or their bid. City reserves the right to reject any and all bids. Bids for the work to be on a guarantee of one year and ten years. The cost of paving the space occupied by the tracks of the Williamsport Passenger Railroad and 8 inches on either side of outside tracks to be paid for by said Williamsport Passenger Railroad Company, the amount to be determined by the measurement made by the city engineer, the city to be in no wise responsible for paving the space occupied by the said railroad company, or expense incurred in collecting same. The city reserves the right to reject any and all bids. Specifications and blank proposals can be obtained from Geo. D. Snyder, City Engineer, City Hall.

24-2t J. J. GALBRAITH, City Clerk.